SID 67-498

STUDY OF APOLLO WATER IMPACT

FINAL REPORT

VOLUME 6

USER'S MANUAL - INTERACTION

(Contract NAS9-4552, G.O. 5264)

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FOREWORD

This report was prepared by North American Aviation, Inc., Space Division, under NASA Contract NAS9-4552, for the National Aeronautics and Space Administration, Manned Space Flight Center, Houston, Texas, with Dr. F. C. Hung, Program Manager and Mr. P.P. Radkowski, Assistant Program Manager. This work was administered under the direction of Structural Mechanics Division, MSC, Houston, Texas with Dr. F. Stebbins as the technical monitor.

This report is presented in eleven volumes for convenience for handling and distribution. All volumes are unclassified.

The objective of the study was to developmethods and Fortran IV computer programs to determine by the techniques described below, the hydro-elastic response of representation of the structure of the Apollo Command Module immediately following impact on the water. The development of theory, methods and computer programs is presented ast Task I Hydrodynamic Pressures, Task II Structural Response and Task III Hydroelastic Response Analysis.

Under Task I - Computing program to extend flexible sphere using the Spencer and Shiffman approach has been developed. Analytical formulation by Dr. Li using nonlinear hydrodynamic theory on structural portion is formulated. In order to cover a wide range of impact conditions, future extensions are necessary in the following items:

a. Using linear hydrodynamic theory to include horizontal velocity and rotation.

b. Nonlinear hydrodynamic theory to develop computing program on spherical portion and to develop nonlinear theory on toroidal and conic sections.

Under Task II - Computing program and User's Manual were developed for nonsymmetrical loading on unsymmetrical elastic shells. To fully develop the theory and methods to cover realistic Apollo configuration the following extensions are recommended:

a. Modes of vibration and modal analysis.

b. Extension to nonsymmetric short time impulses.

c. Linear buckling and elasto-plastic analysis

These technical extensions will not only be useful for Apollo and future Apollo growth configurations, but they will also be of value to other aeronautical and spacecraft programs.

The hydroelastic response of the flexible shell is obtained by the numerical solution of the combined hydrodynamic and shell equations. The results obtained herein are compared numerically with those derived by neglecting the interaction and applying rigid body pressures to the same elastic shell. The numerical results show that for an axially symmetric impact of the particular shell studied, the interaction between the shell and the fluid produces appreciable differences in the overall acceleration of the center of gravity of the shell, and in the distribution of the pressures and responses. However the maximum responses are within 15% of those produced when the interaction between the fluid and the shell is neglected. A brief summary of results is shown in the abstracts of individual volumes.

The volume number and authors are listed on the following page.

The contractor's designation for this report is SID 67-498.

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1.1 INTRODUCTION

The hydroelastic computer program is written entirely in FORTRAN IV and makes use of the overlay feature of that language. The program has been checked out in NAASYS, the NAA adaptation of the IBM 7090/7094 IBSYS/IBJOB system; and uses the NAASYS library routines shown in the load map, pages 4 to 8 inclusive, of Section 1.2.

The NAASYS input tape is Unit 5, the output tape is Unit 6. In addition to these files, the program uses Units 8, 9, 12, and 13 for reserve tapes, Units 10 and 11 as scratch tapes, and Unit 7 as the overlay tape. NAASYS itself is stored on Unit 1.

The program is made up of an executive program and eight links, all of which are called by the executive program. A brief description of each link is shown in Table I below.

Table I. Description of Links

Link No.	Name	Purpose
0	Executive	Reads general data, DA, and controls flow of execution of other links
1	GEOM	Reads geometric parameters. Prints all geometric input and calculated values
2	CDAFIT	Sets up stiffness parameters
3	ACCN	Computes hydrodynamic pressures on the shell
4	DEFLTN	Calculates the deflections due to the pressures
5	PATH	Controls flow after computation of deflections. Computes velocities and accelerations
6	INTLDS	Computes internal loads
7	FSUMS	Outputs all computer quantities
8	PIX	A dummy subroutine for a CRT Plotter

1.2 Load Map

OVERLAY ORIGIN CARDS AND ASSIGNED LINK NUMBERS

```
$ORIGIN     CHAIN                IS LINK   1, PARENT LINK IS   0
$ORIGIN     CHAIN                IS LINK   2, PARENT LINK IS   0
$ORIGIN     CHAIN                IS LINK   3, PARENT LINK IS   0
$ORIGIN     CH. .N               IS LINK   4, PARENT LINK IS   0
$ORIGIN     CHAIN                IS LINK   5, PARENT LINK IS   0
$ORIGIN     CHAIN                IS LINK   6, PARENT LINK IS   0
$ORIGIN     CHAIN                IS LINK   7, PARENT LINK IS   0
$ORIGIN     CHAIN,SYSUT2,REW     IS LINK   8, PARENT LINK IS   0
```

```
                        * MEMORY MA  *

SYSTEM                                      00000 THRU  03765
FILE BLOCK ORIGIN                           03766
FILES        1.      UNIT02
             2.      UNIT03
             3.      UNIT05
             4.      UNIT06
             5.      UNIT12
             6.      UNIT13
FILE LIST ORIGIN                            04076
PRE-EXECUTION INITIALIZATION                04112
CALL ON OBJECT PROGRAM                      04143
OBJECT PROGRAM                              04150 THRU  40312

LIN   DECK  ORIGIN       CONTROL SECTIONS  (/NAME/=NON 0 LENGTH, (LOC)=DELETED, *=NOT REFERENCED)

  0  157DR   04150      ///    /(47246)    EVEN    04151     ......  06212 *
     MMY     06233       MMY    (06233)
     MAD     06401       MAD    (06401)
     .LINK   06511      /.LDT  / 06511    /.LRECT/ 06522    /.LVEC / 06542
     .LXCON  06562       .LXSTR  06562     .LXSTP  06567     .LXOUT  06664     .LXERR  06676
                         IBEXIT  06702 *   .LXRTN  06702     .LXCAL  06706 *   .DBCLS  07074 *
                         .LXARG  07215     .LO     07234    /TDUMPQ/ 07236 *   .CLSE   07242
                         .LFBL   07243 *   .LUNB   07244     .DFOUT  07245     CTES..  07247 *
                         SC.SWT  07250    /SMR1.V/ 07251     .OPNFQ  07270     .CLSFQ  07271
                         .WRTFQ  07272     .REDFQ  07273     CNTL..  07274
     .IODEF  07277       .DEFIN  07277     .ATTAC  07303 *   .CLOSE  07305     .OPEN   07307
                         .READ   07311     .WRITE  07313     .BSR    07323 *   .READR  07333 *
                         .RELES  07335 *   .LAREA  07346 *   .LFBLK  07364     .LTSX   07367 *
                         .AREAI  07401     .LUNBL  07407 *   .ENTRY  07413     .GOA    07446
                         .GO     07452     .DERR   07466     .NOPXI  07472     .COMXI  07474
                         .EX34   07516     ..FPUN  07523     ..PLOT  07523
     .IOCSF  07524
     .LOVRY  13046       .LOVRY (13046)    .LDT   (06511)    .LRECT (06522)    .LVEC  (06542)
     .LXSL   13620       .LXSEL  13620     .LXSCL  13621     .LXTST  13624 *   .LXOVL  13672 *
                         .LXRCT  13703 *   .LXIND  14042     .LXDIS  14050     .LXFLG  14051
```

		.LTCH	14056								
.FPTRP	14076	.FFPT.	14076 *	.FPOUT	14232	.FPARG	14242	/.COUNT/	14244 *		
		OVFLOW	14315 *								
.ERAS.	14322	E.1	14322	E.2	14323	E.3	14324	E.4	14325		
.XCC.	14326	CC.1	14326	CC.2	14327	CC.3	14330	CC.4	14331		
XIT	14332	EXIT	14332	.EXIT.	14332						
FXEM	14333	.FXEM.	14333	.FXOUT	14666	.FXARG	14674	/.OPTW./	14750		
OPXP.Q	14762	RDOPXQ	14762 *	OPEXQ	14764						
FOUT	15030	.FOUT.	15030								
FCNV	15371	.FCON.	15371	/HWDSQ /	15421 *	/NOHSHQ/	15423 *	.FCNV.	15425		
		.ENDFS	15444	.CNVSW	15446	.FDX1	15452	.FDX2	15453		
		.DBC	15455	.DBC10	15613	.DBC20	15641	.DDSW	15651		
		.DDFIX	15660	.FIXSW	15666	.DDBC	15743	.DDRS1	16206		
		.DDRS2	16210 *	.D1	16213	.D2	16215	.FERR2	16302 *		
		.ANPT	16336	.ONPT	16353	.LNTP	16436	.AOUT	16505		
		.DFLT	16524	.FLT	16661	.DEXPN	16752	.FXD	16753		
		.HOUT	17104	.INTG	17155	.LOUT	17275	.OOUT	17316		
		.XCF	17350	.TEST	20056	.KOUNT	20061	.LIST	20064		
		.DONE	20075	.OUTBF	20142	EVEN	20141	.BUF	20172		
		.QSTO	20173	.WIDTH	20174	.GAIN	20175	.GAIN1	20176		
		.FBDBF	20206	EVEN	20217	.DDDFL	20233	.DDFLG	20234		
		.MQD	20235	.PEX	20236	.FEXP	20237	.DIG	20240		
FIOB	20256	.FIOB.	20256	.FCNT	20361	.FBLT.	20457	.FBDT.	20477		
		.FRLR.	20523	.FRLR.	(20523)	.FWLR.	20567	.FWLR.	(20567)		
		.FBIBF	20627	.FRITE	20721						
FIOS	20727	.FIOS.	20727	.FSEL.	21116	.FILR.	21122 *	.FRTB.	21131		
		.FRTD.	21136	.FILL.	21144	.FCLS	21171 *	.FOPN	21175 *		
		REOF	21201 *	REOF.Q	21210 *	.TOUT.	21344	.REED	21354 *		
		.BIN	21355 *	.FCT	21356	.FCKSZ	21360	SEOF.Q	21401 *		
FIOH	21457	.FIOH.	21457	.FFIL.	22244	.FRTN.	22271				
FWRD	22467	.FWRD.	22467								
FWRB	22513	.FWRB.	22513								
FRDD	22537	.FRDD.	22537								
FRDB	22565	.FRDB.	22565								
UNO2	22611	.UNO2.	22611								
UNO3	22612	.UNO3.	22612								
UNO5	22613	.UNO5.	22613								

	UN06	22614	.UN06.	22614	.BUFSZ	22615					
	UN12	22620	.UN12.	22620							
	UN13	22621	.UN13.	22621							
	FLOG	22622	ALOG10	22622 *	ALOG	22623					
	FXPF	23026	EXP	23026							
	FSCD	23147	COSD	23147	SIND	23151					
	FSCN	23200	COS	23200	SIN	23201					
	FSQR	23374	SQRT	23374							
	FXP2	23447	.XP2.	23447							
	FXP3	23565	.XP3.	23565							
	FRWT	23712	.FRWT.	23712							
	FSLDI	24031	.FSLI.	24047	.FSDI.	24055 *					
	FSLI	24066	.SLI.	24066	.SLI1.	24073	.SDI.	24101	.SDI1.	24107	
	FSLDO	24122	.FSLO.	24140	.FSDO.	24146 *					
	FSLO	24157	.SLO.	24157	.SLO2.	24165	.SDO.	24172	.SDO2.	24201	
	DECRD	24213	DECRD	(24213)							
	FASC	24331	ARCOS	24331 *	ARSIN	24332					
	//	47246									
1	GMTRY	24462	///	/(47246)	EVEN	24463	GFOM	33034			
	CF3P	33055	CODIM4	34070							
2	CDAFIT	24462	///	/(47246)	EVEN	24463	CRVFIT	31213			
	CODS	31231	CODIM4	32244							
	ENTP	32372	EVEN	32373	ENTERP	32572					
3	ACCN2	24462	///	/(47246)	EVEN	24463	ACCN	30566			
4	157DR1	24462	///	/(47246)	EVEN	24463	DEFLTN	37412			
	MSU	37441	MSU	(37441)							
	INVRS	37551	INV	40240							
5	WHERE	24462	///	/(47246)	EVEN	24463	PATH	25317			
6	157DR2	24462	///	/(47246)	EVEN	24463	INTLDS	26603			
7	FSUMS	24462	///	/(47246)	EVEN	24463	SUMS	25720			

```
  8  LNK6     24462        EVEN     24463      PIX      24476

I/O BUFFERS                              40313 THRU  47117

UNUSED CORE                              47120 THRU  47245
BEGIN EXECUTION     32                                        00-00-42
```

1.3 Iterative Process Within Each Time Interval for the Pressure Determination

According to Equation (24) of Volume 3 of this report, the pressures on the penetrating shell of revolution during vertical axisymmetric impact into a fluid are given by

$$p = \frac{2}{\pi}\rho\left[\frac{RV^2}{c} + c\mu\frac{\partial V}{\partial t}\right] + \frac{\rho}{2}\sum_{s=0}^{\infty} f_s \left\{ \frac{RV}{c}\left[p_m(\mu) + \frac{1-\mu^2}{\mu}\frac{\partial}{\partial \mu} p_m(\mu)\right]\int_0^1 \eta v(\eta, t) p_m(\eta) d\eta + c\, p_m(\mu)\int_0^1 \eta p_m(\eta)\frac{\partial v}{\partial t}(\eta, t) d\eta \right\} \quad (1)$$

Here,

ρ mass density of fluid

R radius of curvature of shell at impact point

V instantaneous velocity of center of gravity

c radius of wetted surface

$v(\eta, t)$ instantaneous velocity of shell surface

$p_m(\mu)$ is a Legendre polynomial

$\mu = \left(1 - r^2/c^2\right)^{1/2}$

r radial coordinate

$$f_s = \frac{4s + 3}{\pi} \left[\frac{(s!)^2 \, 2^{2s+1}}{(2s + 1)!} \right]^2$$

$$m = 2s + 1$$

In the computer program, the series is truncated at s = 3, satisfactory convergence having been achieved. It can be seen that the pressures are dependent on the overall velocity V of the center of gravity, and on the structural velocities v and their time derivatives. Thus, the pressures are coupled closely to the shell deformations.

In the computer program, an iterative process is used within each time increment in order to compute both the pressures and the shell responses so that they satisfy all the given equations to within some given convergence criterion. The iterative process is shown in diagramatic form in Figure 1. The controlling input data for the iterations are CONV, the convergence criterion, and IVX, the maximum allowable number of iterations per time cycle. If the number of iterations exceeds IVX, the program considers the iteration cycle complete and simply goes on to the next time. Should this happen, the responses of the subsequent time cycles may not be satisfactory, and the job should be restarted with a larger IVX.

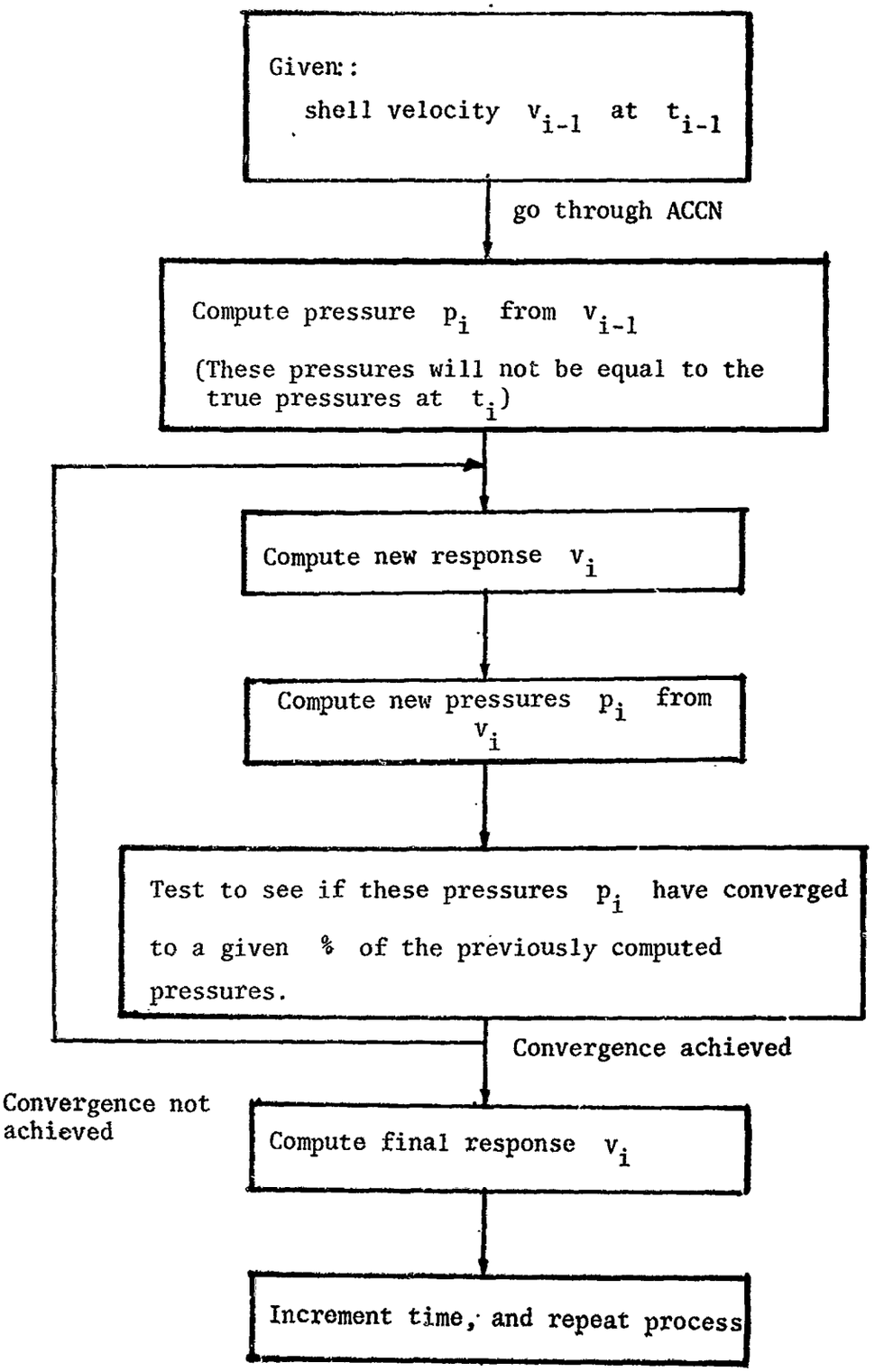


Figure 1. Iterative Procedure to Find Pressure and Response at Time t_i

2.1 PROGRAM FLOW DESCRIPTION

An overall flow diagram of the executive program 157DR is shown in Figure 2. A listing of the complete program is shown in Section 7.1.

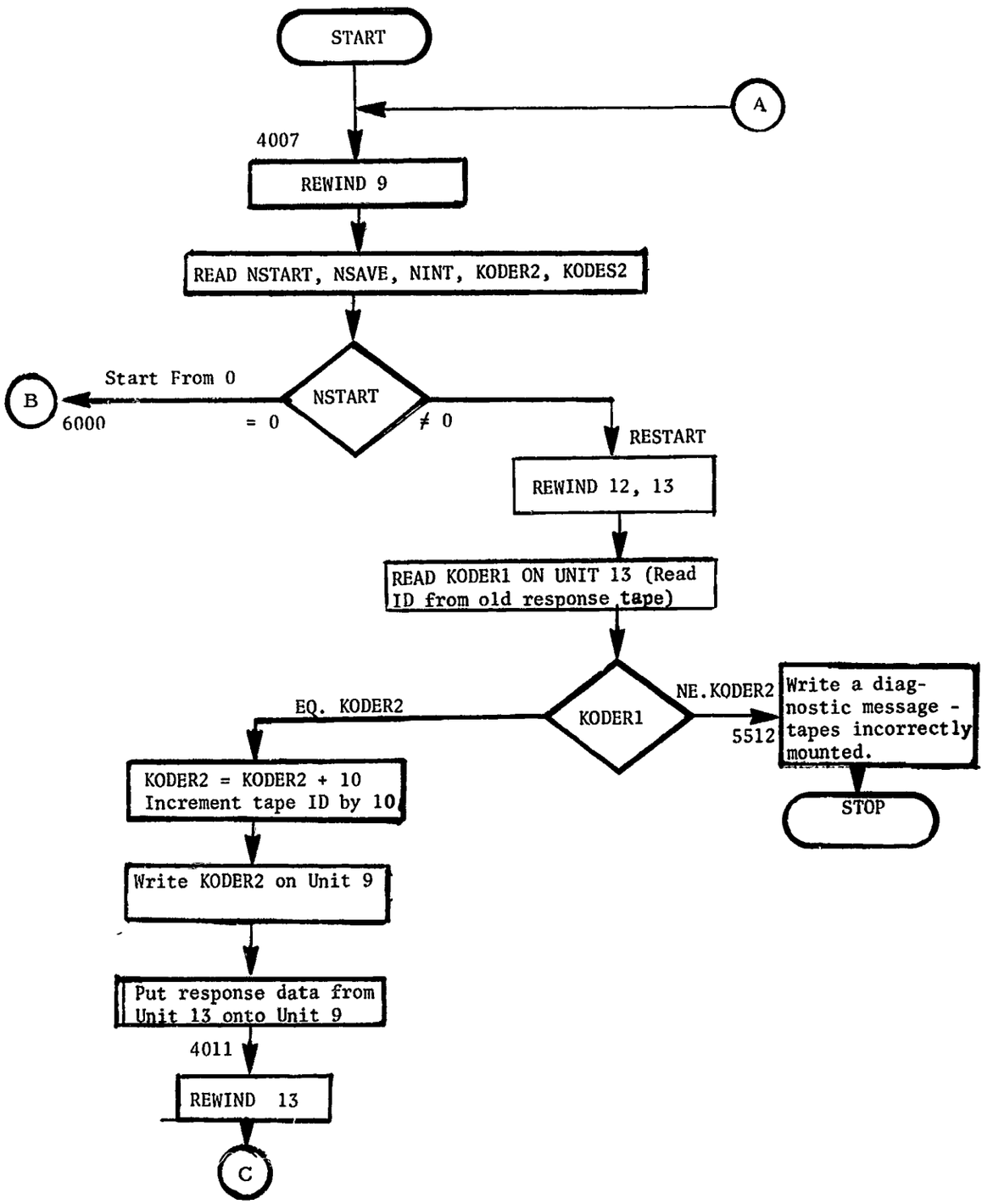


Figure 2. Flow of Executive Program 157DR (Sheet 1 of 6)

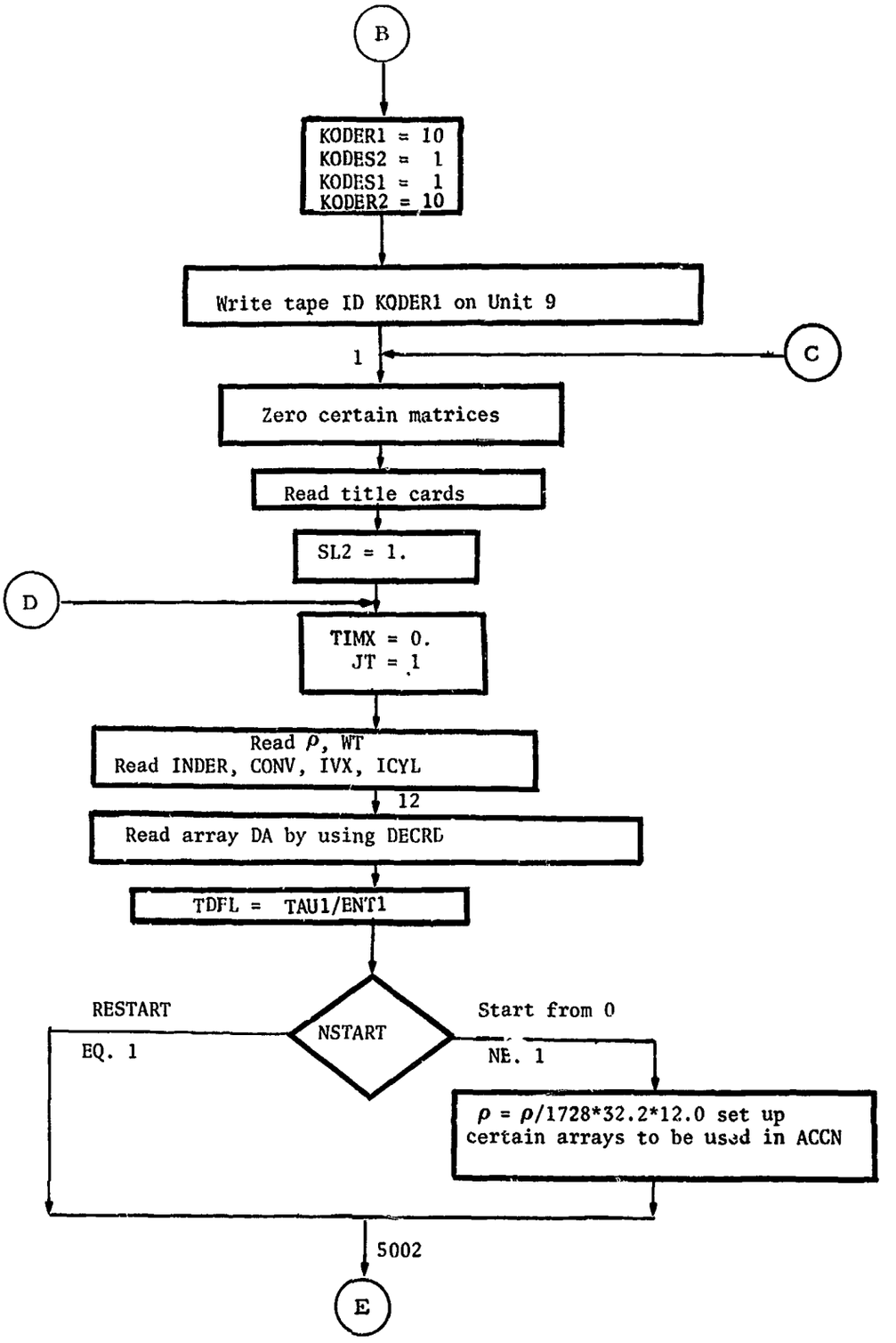


Figure 2. Flow of Executive Program 157DR (Sheet 2 of 6)

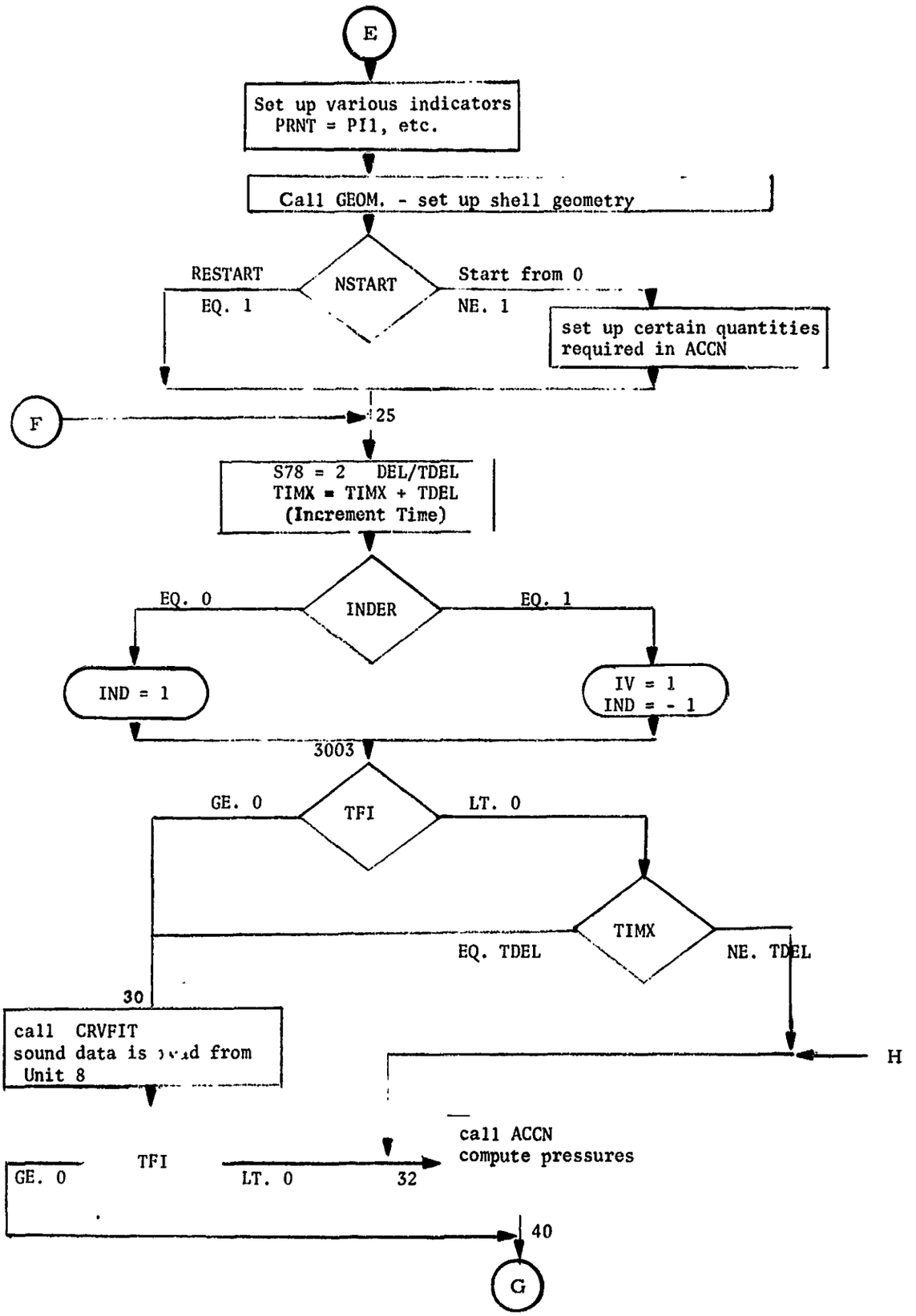


Figure 2. Flow of Executive Program 157DR (Sheet 3 of 6)

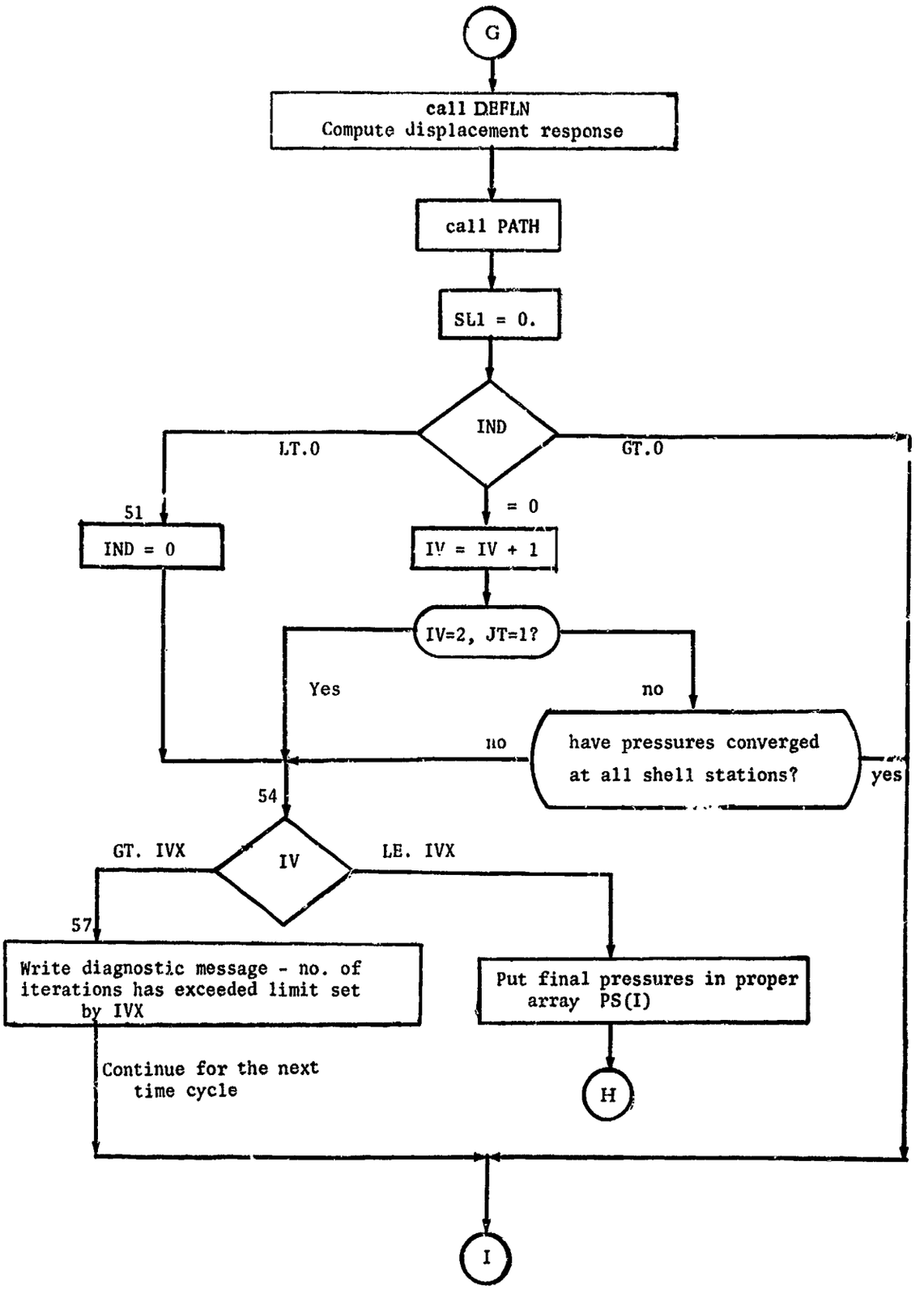


Figure 2. Flow of Executive Program 157DR (Sheet 4 of 6)

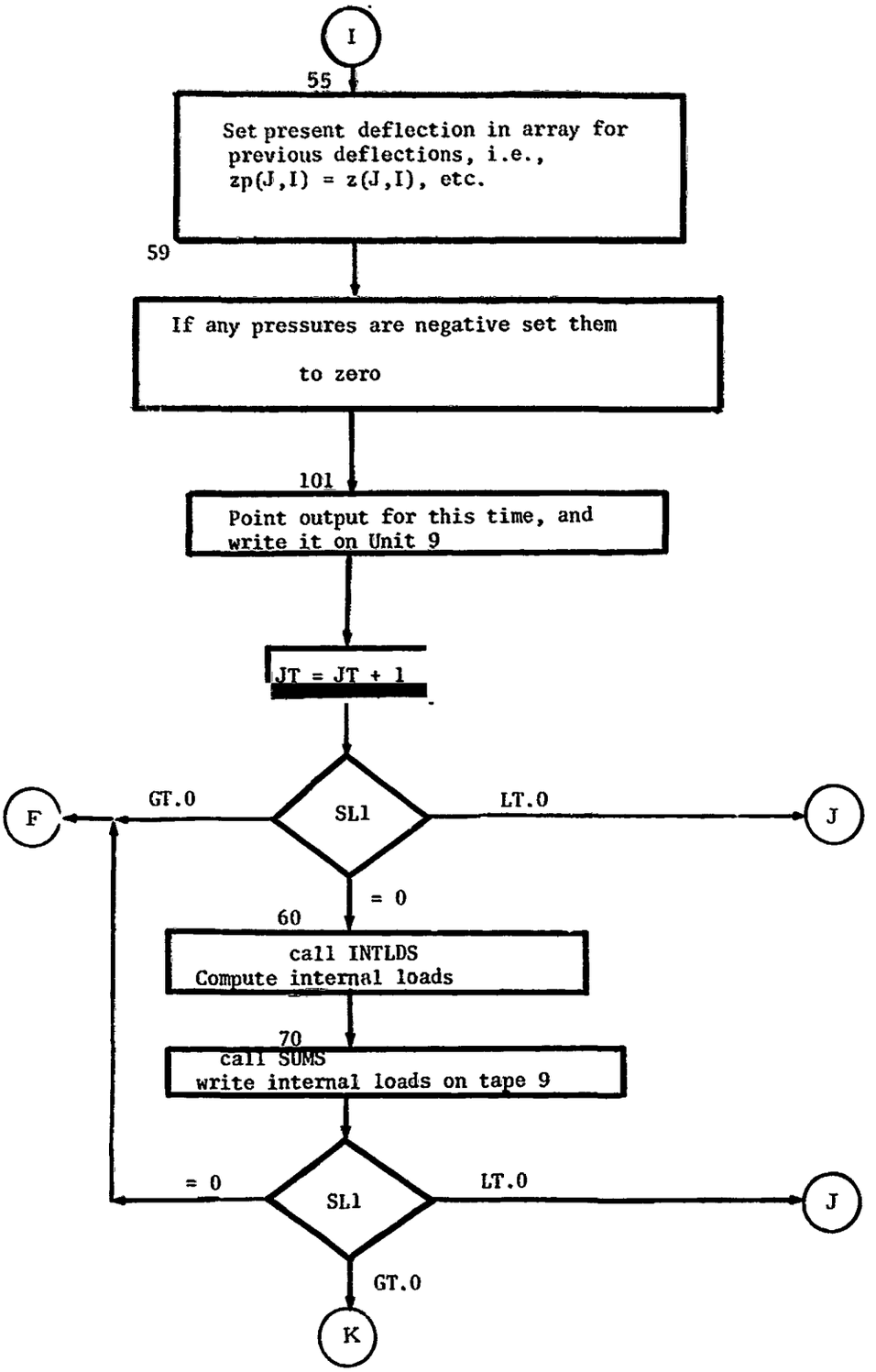


Figure 2. Flow of Executive Program 157DR (Sheet 5 of 6)

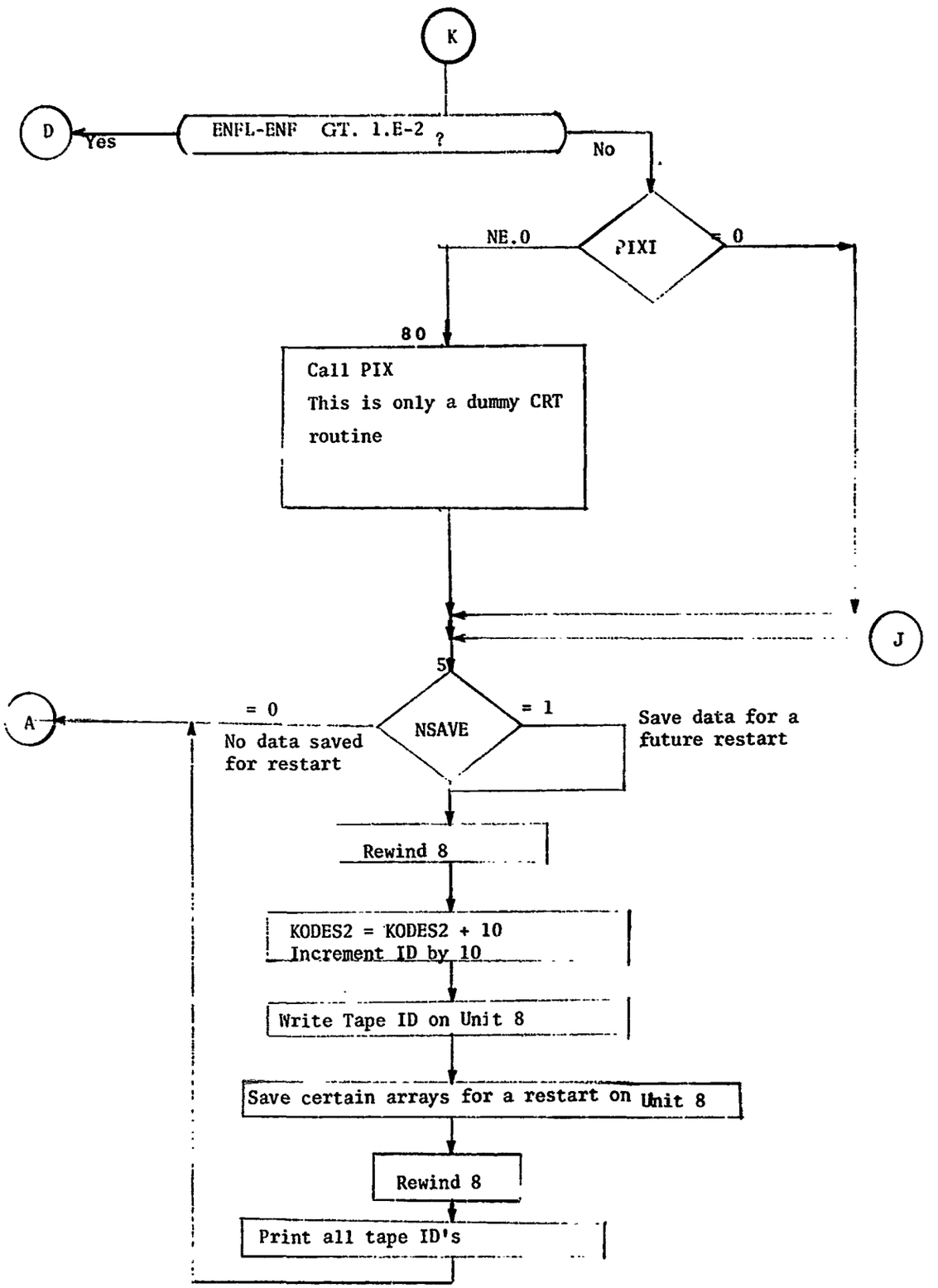


Figure 2. Flow of Executive Program 157DR (Sheet 6 of 6)

2.2 Program Deck Setup

As explained in Section 1.1, the deck is set up in overlay regions. Each region is denoted by a $ORIGIN control card. A list of the setup is shown below. It includes the control cards and deck names. The order of these decks must be kept in the given sequence.

Control Cards		Subroutines
$IBJOB		
$IBFTC	157 DR	Main program
$IBFTC	MMPY	MMY
$IBFTC	MADD	ADD
$ORIGIN	CHAIN	
$IBFTC	GMTRY	GEOM
$IBFTC	CF3P	CODIMA
$ORIGIN	CHAIN	
$IBFTC	CDAFIT	CRVFIT
$IBFTC	CODS	CODIM4
$IBFTC	ENTP	ENTERP
$ORIGIN	CHAIN	
$IBFTC	ACCN2	ACCN
$ORIGIN	CHAIN	
$IBFTC	157DR1	DEFLTN
$IBFTC	MSUB	MSU
$IBFTC	INVRS	INV
$ORIGIN	CHAIN	
$IBFTC	WHERE	PATH
$ORIGIN	CHAIN	
$IBFTC	157DR2	INTLDS
$ORIGIN	CHAIN	
$OBFTC	FSUMS	SUMS
$ORIGIN	CHAIN, SYSUT2, REW	
$IBFTC	LNK6	PIX
$DATA		

3.1 TAPE USAGE

In order to permanently preserve the computer output in an easily accessible form, it is put out on a reserve tape. In addition, to enable the user to continue a job after the program has been run to a certain time (say 1.0 ms.), certain arrays are saved on another tape so that a restart can be subsequently made for calculations from 1.0 ms. to, say, 2.0 ms. This saving of certain arrays avoids the complete recalculation from 0 to 1.0 ms.

Because the mounting of reserve tapes is subject to human error, the first word on each tape is an identification code. This identification is automatically written on the tape when it is created and is printed on the final printed output at the end of the job. Before a tape is read by the computer, its identification is checked with a code which is part of the card input - KODER2 and KODES2. If the identification checks, the job proceeds; if not, then a diagnostic printout is made stating which tape is incorrectly mounted, and the job is stopped. It is therefore important to know the correct tape identification and keep track of it throughout all restart conditions.

To start a job from time zero, any two available tapes are mounted on logical units 8 and 9 (See Figure 3). The tape on unit 8 will be denoted by Tape A, and that on 9 will be denoted by Tape B. At the end of the job, Tape A will contain the saved arrays necessary for a restart. Tape B will contain the response in the order shown in Figure 4, where each line denotes a single record of the tape. As each tape is created, the identification code is written on it as the first record. Thus, Tape A, the "saved-data" tape, has the identification.

EDPM JOB REQUEST SUPPLEMENT

JOB NO.	REQUESTED BY	PHONE

ADDITIONAL INSTRUCTIONS

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 8

PUT FILE RING IN

Comment: This tape will hold the saved data for a future restart. Denote this tape by Tape No. A. Its identification word KODES2 = 10.

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 9

PUT FILE RING IN

Comment: This tape will hold the shell response Remote taype by B. Its identification No. is KODER2 = 11.

☐ SEE BACK OF FORM

TAPE USAGE

AUTH NO. _____ NAME _____

JOB NO. _____ DATE _____

PHONE _____ DEPT _____ GROUP _____

UNIT	REEL NO.	TAPE ID	DESCRIPTION	MINIMUM LENGTH	RESERVE THIS TAPE	FILE THIS TAPE	RETURN WITHDRAWN TAPE	RELEASE RESERVE TAPE	WITHDRAW UNRESERVED TAPE	WITHDRAW RESERVED TAPE
8	A	10	Saved data at 1.0 ms.		✓					
9	B	11	Response 0 - 1.0 ms.		✓					

Figure 3. Tape Usage for a Start from 0 Time

FORM 114-A-11

KODER2
JT, TIMX, AP, VEL, ACC, BP, N, NOT
PN(I), I = 1, NOT
PM(I), I = 1, NOT
PE2(I), I = 1, NOT
USUM(I), I = 1,N
WSUM(I), I = 1,N
EMFE(I), I = 1,N
EMTH(I), I = 1,N
QFE(I), I = 1,N
QTH(I), I = 1,N
ENFE(I), I = 1,N
ENTH(I), I = 1,N
SIGFE(I), I = 1,N
SIGTH(I), I = 1,N
ZDOT(1, I), I = 1,N
ZDOT(3, I), I = 1,N
Z2DOT(1, I), I = 1,N
Z2DOT(3, I), I = 1,N

This information is repeated for each time interval

Figure 4. Contents of Tape B, Created on Logical Unit 8

KODER2 = 10,

while Tape B, the response tape, has the identification

KODES2 = 11.

Let us say that the job was stopped at t = 1.0 ms. In order to restart it, and run to t = 2.0 ms, the following tape manipulations are required. Any two available tapes are mounted onto logical units 8 and 9 (See Figure 5). Let us denote the tape on unit 8 by Tape C, and that on unit 9 by Tape D. Tape C will contain the "saved data" at the end of the job at t = 2.0 ms, while Tape D will contain the complete response from 0 to 2.0 ms. In addition to these two new tapes, Tapes A and B from the previous run are mounted on logical units 12 and 13, respectively (See Figure 5). At the beginning of the job, the identification number KODER2 of Tape B is read and if it is the correct number, the information on Tape B is placed on Tape D. Thus, Tape C now contains the response from 0 to 1.0 ms. Then, the identification number of Tape A is checked, and if it is correct, the "saved data" on Tape A is placed in common storage, and the job is started. At the end of the job, Tape D on logical unit 9 will contain the response from 0 to 2.0, while Tape C on logical unit 8 will contain the "saved data" at t = 2.0 ms, for a subsequent restart.

The identification numbers of the response tapes and the "saved data" tapes are incremented by 10 during each restart. Thus, the identification numbers of the newly created Tapes C and D are

KODER2 = 20

KODES2 = 21

respectively.

For a subsequent restart, new tapes are mounted on logical units 8 and 9 and, now, tapes C and D are mounted on logical units 12 and 13.

EDPM JOB REQUEST SUPPLEMENT

JOB NO.	REQUESTED BY	PHONE

ADDITIONAL INSTRUCTIONS

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 8

PUT FILE RING IN

Comment: This tape will hold saved data for a future restart. Denote this tape by Tape No. C. Its identification number will be KODES2 = 20.

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 9

PUT FILE RING IN

Comment: This tape will hold response from 0 to 2 ms. Denote this tape by Tape No. D. Identification KODER2 = 21.

MOUNT TAPE A ON LOGICAL UNIT 12

Comment: This tape is for the restart.

MOUNT TAPE B ON LOGICAL UNIT 13

Comment: This tape holds the response from 0 to 1 ms., and its information is put onto Tape C at beginning of job.

☐ SEE BACK OF FORM

TAPE USAGE

AUTH NO. _____ NAME _____

JOB NO. _____ DATE _____

PHONE _____ DEPT _____ GROUP _____

UNIT	REEL NO.	TAPE ID	DESCRIPTION	MINIMUM LENGTH	RESERVE THIS TAPE	FILE THIS TAPE	RETURN WITHDRAWN TAPE	RELEASE RESERVE TAPE	WITHDRAW UNRESERVED TAPE	WITHDRAW RESERVED TAPE
8	C	20	Saved data at 2.0 ms.		✓					
9	D	21	Response 0 - 2.0 ms.		✓					
12	A	10	Saved data at 1.0 ms.					✓		
13	B	11	Response 0 - 1.0 ms.					✓		

Figure 5. Tape Usage for a Restart at 1.0 ms., to 2.0 ms.

FORM 114-A-11

4.1 INPUT DATA FORMAT

Data are entered into the program by three subroutines. The executive program 157DR reads the hydrodynamic data, and the DA region of the shell data. Subroutine GEOM reads the GDA region of shell data, and subroutine CDAFIT reads the CDA region of the shell data. The regions DA, GDA, and CDA are read by means of the DECRD subroutine.

4.2 DECRD Subroutine

The data in regions DA, GDA, and CDA is read by means of the DECRD subroutine. A description of the subroutine follows, together with a listing in FORTRAN IV.

DECRD Decimal Read

1. Description. When a minus sign is encountered in column 1 of a DECRD data card, that card will be read and then reading will be terminated.

   The index of a DECRD card must be written to the extreme right of the first 12-column field.

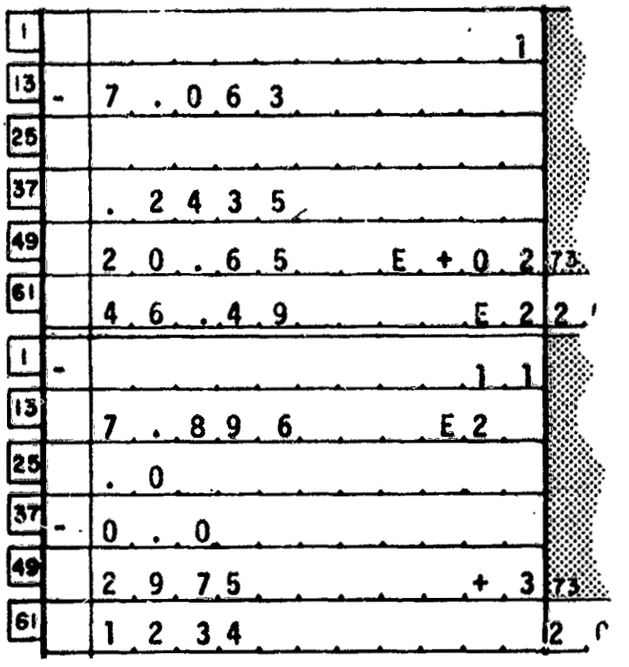
2. Extent: 78 locations.

3. Call statement: CALL DECRD (ARRAY)

   where ARRAY is the name of the real array to be read. This argument may be subscripted.

4. Error indication: If the index field is zero or blank, the comment "BAD DATA CARD" and the contents columns 73-80 of the defective card will be printed. The job will be terminated.

5. Example: Assume a CALL DECRD (ARR) statement and t the following data cards.



The first card will result in information being stored as follows:

ARR(1) -0.7063E 01 ARR(3) 0.2435E-00 ARR(5) 0.4649E 04
ARR(2) Unchanged ARR(4) 0.2065E 04

The - sign in column 1 of the second card signals that this is the last card to be read under control of this CALL DECRD statement. This card has been written to illustrate some types of errors (or possible errors) in writing the data. The information will be stored as follows:

ARR(11) 0.7896E 21 (Exponent mislocated or incomplete.)
ARR(12) Unchanged (Treated as a blank.) ARR(14) 0.2975E 04
ARR(13) Unchanged (Treated as a blank.) ARR(15) 0.1234E 03

When no decimal point is written, as in the last two items, the data is read by the E12.8 format; the number of decimal places is counted from the beginning of the exponent field, if any, or from the extreme right of the field.

```
$IBFTC DECRD                                                            DECRD000
      SUBROUTINE DECRD(D)                                               DECRD005
      DIMENSION  FLT(5), ID(2), D()                                     DECRD010
   10 READ (5,100) LOC, FLT, ID                                         DECRD015
  100 FORMAT (I12, 5E12.0, 1A6, 1A2)                                    DECRD020
      IF (LOC .EQ. 0)   GO TO 500                                       DECRD025
   15 K = IABS(LOC) - 1                                                 DECRD030
      DO 20 I = 1,5                                                     DECRD035
      IF (SIGN(1.0,FLT(I)).LT.0.0 .AND. FLT(I) .EQ. 0.0)  GO TO 20      DECRD040
      J = K + I                                                         DECRD045
      D(J) = FLT(I)                                                     DECRD050
   20 CONTINUE                                                          DECRD055
      IF (LOC .LT. 0)  GO TO 1000                                       DECRD060
      GO TO 10                                                          DECRD065
  500 WRITE (6,200) ID                                                  DECRD070
  200  FORMAT(10H0BAD DATA 1A6,1A2)                                     DECRD075
      CALL EXIT                                                         DECRD080
 1000 RETURN                                                            DECRD085
      END                                                               DECRD090
```

4.3 Data Deck Setup

Data decks should be stacked as follows:

1. Indicator card with NSTART, etc.
2. Three title cards (which may be blank, if necessary).
3. A card with RHO, WT.
4. An indicator card with INDER, etc.
5. DA, general shell data, read by executive program.
6. GDA, geometry data, read by GEOM subroutine.
7. CDA, section properties data, read by CDAFIT subroutine.

The data in groups 5, 6 and 7 should have a minus sign in column 1 of the last card.

The following tables show the nature of the DA, GDA, and CDA decks.

4.4 Call DECRD (DA)

DECRD Index	Name	Description	
1	EN	No. of points along shell meridian	
2	AO	Reference length (in.)	For most cases set to 1.0
3	HO	Reference thickness (in.)	
4	EO	Reference Young's Modulus (psi)	
5	SIGO	Reference stress (psi)	
8	POI	Poisson's ratio	
11	SPRL	Location of spring along meridian	
12	UK	Spring value in ξ direction	
14	WK	Spring value in normal direction	
16	TAU1	Length of total time interval from zero	
17	ENT1	Total no. of time intervals from zero to TAUI	
18	PI1	Print interval (will always print last interval)	
25	MASS	Mass density of shell, lbs. sec^2/in^4	
26	CFE	Coefficient of viscous damping at each station in ξ direction	
27	CZ	Coefficient of viscous damping in normal direction.	
28	SKFE	Spring constants of shell under elastic restraint in ξ direction.	
29	SKZ	Spring constant at each station in normal direction.	
30	SUM	Fourier summing increment (always -1.)	

DECRD Index	Name	Description
33	TFI	(Always - 1)
34	VIN	Initial impact velocity, in./sec.
36	RESTRT.	0. for start from zero, 1. for restart
4440	EM1	See description of top boundary conditions in Section 4. 5. 1
4476	EM1N	See description of bottom boundary conditions in Section 4. 5. 2

Last card must have a - sign in Column 1.

4.5 Boundary Conditions

4.5.1 Top Boundary

When the boundary conditions on the top boundary are of the following kind, a special flag can be used to specify them:

free: $\left(N_\xi = \hat{N}_{\xi\theta} = \hat{F}_\xi = M_\xi = 0 \right) = 1.$

roller: $\left(N_\xi = u_\theta = W = M_\xi = 0 \right) = 2.$

fixed: $\left(u_\xi = u_\theta = W = \phi_\xi = 0 \right) = 3.$

simply supported: $\left(u_\xi = u_\theta = W = M_\xi = 0 \right) = 4.$

complete: $\left(u_\xi = u_\theta = \hat{F}_\xi = \phi_\xi = 0 \right) = 5.$

In these cases, DA(4440) = 1. E10, and DA(4441) is given the value 1., 2., 3., 4., or 5. as shown above. Other special boundary conditions may also be specified. As an example, the full boundary (which is also given above) can be specified as shown in the following data sheets.

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER_____ DATE_____ PAGE_____ of_____

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
4 4 4 0		Diagonal Boundary Force Matrix
1 •		EM1(4 × 4), omega at top of shell.
	73 80	e.g.(free boundary) $\begin{bmatrix} 1 & & & \\ & 1 & & \\ & & 1 & \\ & & & 0 \end{bmatrix}$
4 4 4 5		EXAMPLE,
1 •		EM1 (contd)
	73 80	
4 4 5 0		EXAMPLE
1 •		EM1 (contd)
	73 80	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER_____ DATE_____ PAGE_____ of_____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	4456	73 80	Diagonal Boundary Displacement Matrix
13	0.		EM3(4 × 4) Lambda at top of shell
25			
37			e.g. (for free boundary) $\begin{bmatrix} 0 & & & \\ & 0 & & \\ & & 0 & \\ & & & 1 \end{bmatrix}$
49			
61			
1	4471	73 80	EXAMPLE
13	1.0		EM3 (cont'd)
25			
37			
49			
61			
1	4472	73 80	Column Boundary Matrix
13	0.0		EM5(4 × 1), L, at top of shell.
25			
37			e.g. L = $\begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix}$
4			
61			

4. 5. 2 Bottom Boundary

The same selection of boundary conditions is available here as for the top boundary. This time, the indicator specifying the free, roller, fixed, simply supported, and complete conditions are set as follows:

DA (4476) = 1. E10

DA (4477) = 1., 2., 3., 4., 5.,

according to the boundary condition desired. An example of other possible boundary conditions is given in the data sheets below. The example here is the free boundary (the same as in Section 4. 5. 1).

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER_____ DATE_____ PAGE_____of_____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	4476	73 80	Diagonal Boundary Force Matrix
13	0.0		EM1N(4 × 4) OMEGA at Bottom of shell.
25			
37			e.g. (fixed boundary) $\begin{bmatrix} 0 & & \\ & 0 & \\ & & 0 \\ & & & 1 \end{bmatrix}$ 4476 15/4491
49			
61			
1	4491	73 80	EXAMPLE
13			EM1N (cont'd)
25	1.0		
37			
49			
61			
1	4492	73 80	Diagonal Boundary Displacement Matrix
13	1.0		EM3N(4 × 4), LAMBDA at Bottom of shell.
25			
37			e.g. (for fixed case), $\begin{bmatrix} 1 & & & \\ & 1 & & \\ & & 1 & \\ & & & 0 \end{bmatrix}$
49			
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	4497		EXAMPLE
13	1.0		EM3N (cont'd)
25			
37			
49		73 80	
61			
1	4502		EM3N (cont'd)
13	1.		
25			
37			
49		73 80	
61			
1	4505		Column Boundary Matrix
13	0.0		EM5N (4 × 1), L, at Bottom of shell.
25			
37			e.g. L = {0}
49		73 80	
61			

4.6 Call DECRD (GDA)

DECRD Index	Name	Description
1	GMI	Geometry indicator: 1. = cone - cylinder 2. = sphere - toroid 3. = general discrete point 4. = arbitrary functions
2	EN	No. of station points
3	PFLAG	print indicator; ≠ 0., prints all data
4	RA1	for GMI = 1.; radius at station 1
	RC	for GMI = 2.; radius of curvature
5	AXL	for GMI = 1.; axial surface length
	ROFF	for GMI = 2.; off-set distance to center of curvature
6	ANX	for GMI = 1.; angle between generator and axis of revolution.
	PHIO	for GMI = 2.; initial opening angle from vertical axis, in degrees.
7	PHIN	for GMI = 2.; final opening angle from vertical axis, in degrees.
8	EM	for GMI = 3.; number of RI points given
9-208	RIPT	for GMI = 3.; Discrete radii (200 points maximum)
209-409	XIPT	for GMI = 3.; Discrete XI - arc lengths, (200 points maximum)

The last card must have a - in Column 1.

4.7 Call DECRD (CDA)

The various tables are set up in this region as follows:

TAB (1) = No. of stations given along meridian (i.e., stations at which values change).

TAB (2) = Station No. 1.

TAB (3) = Parameter value at Station No. 1

TAB (4) = Next station no.

TAB (5) = Next parameter value

Stations and parameter values interlaced.

The last station must be the Nth station parameter value because CODIMA interpolation routine will not extrapolate.

If $+1.0 \times 10^{10}$ is placed in TAB (1) the following parameter value is constant (uniform over all stations EN) and its value is placed in TAB (2).

DECRD Index	Name	Description
		Extensional Rigidity
1	DB	No. of stations given if = 1.E10, then a constant extensional rigidity is given in 2
2		Station No. 1 if CDA (1) = 1.E10, then this is a constant value of extensional rigidity.
3		Value of extensional rigidity between Station 1 and next station
4		Station No. 2
5		Value of extensional rigidity
6-41		Follows same pattern to DTB (20), value of last rigidity.

DECRD Index	Name	Description
		Flexural Rigidity
42	EKTB	No. of stations given if = 1. E10, then a constant flexural rigidity is given in 43
43		Station No. 1 if CDA (42) = 1. E10, then this is the constant value of flexural rigidity
44		Value of flexural rigidity between station 1 and next station
45		Station No. 2
46		Value of flexural rigidity
47-81	Follows same pattern to EXTB (20), value of last rigidity.	
		Continue as above for the following quantities:
83-123	EITB	Young's modulus (E)
124-164	ALFTB	Coefft of thermal expansion (α)
165-205	DNATB	1/2 shell thickness (h/2)
206-246	TTB	Temperature gradient through shell (T)
247-287	ENTB	Membrane thermal load

DECRD Index	Name	Description
288-328	EMTB	Bending thermal load
329-369	PNTB	Normal pressure on shell (at reference surface)
370-410	PFETB	Meridional surface pressure (at reference surface)
452-492	DZOTB	Initial displacement in normal direction.
493-533	VZOTB	Initial velocity in normal direction
534-574	QZOTB	Initial acceleration in normal direction
575-615	DFOTB	Initial displacement in ξ direction
616-365	VFOTB	Initial velocity in ξ direction.
657-691	QFOTB	Initial acceleration in ξ direction.

The last card must have a - sign in Column 1.

5.1 SAMPLE PROBLEM

To demonstrate the use of the computer program, and to illustrate the format of the input and output data, the sample problem shown in Figure 6 has been calculated.

The problem concerns the vertical impact of a flexible body of revolution consisting of a shallow spherical shell to which is rigidly attached a heavier mass so that their combined weight is 10,000 lbs. The radius of curvature of the shell middle surface is 175.6 ins., and the opening angle is 19.53°. The shell extensional and flexural stiffnesses are both set equal to 3.33×10^6 lbs/in., which corresponds to a sandwich shell having 0.05 in. steel facings and 1.95 in. honeycomb core. Other shell properties are as follows: Mass per unit surface area = 9.7×10^{-4} lbs. sec.^{2}/in.^{3}; Poisson's ratio = 0.33, and modulus of elasticity E = 29.7×10^6 psi. The initial impact velocity is 30 fps.

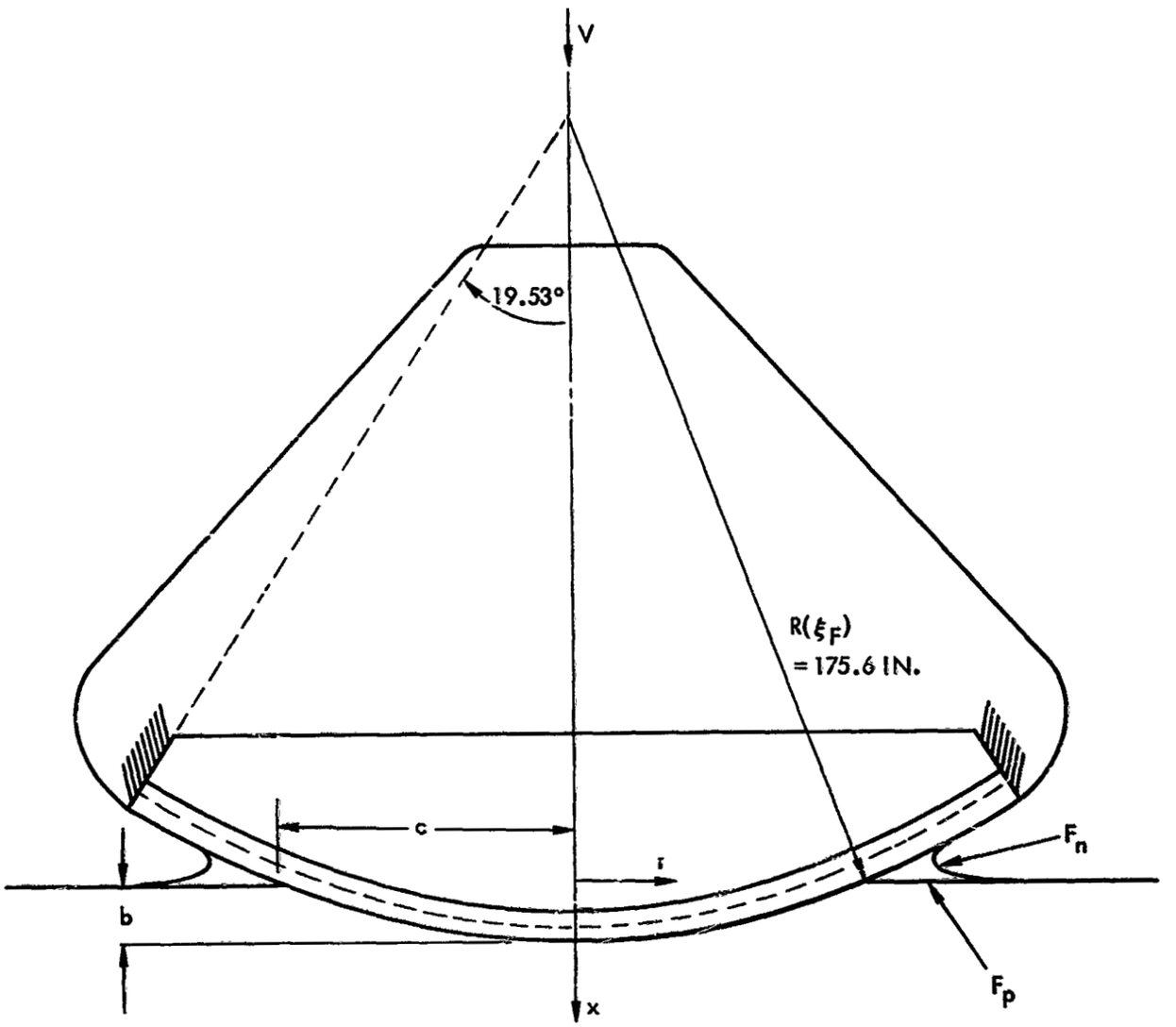


Figure 6. Model of Sample Problem.

5.2 Sample Input Data and Tape Usage

Because of the amount of computer time consumed in a single hydroelastic computer run, it is well to split the total run into small subsections in order to be able to progressively check the output data as it is calculated. This is done by restarting the problem at various times as described in Section 3.1 on tape manipulations.

The present sample problem will be run to 2.0 ms, (although a usual run would be in the order of 8 to 15 ms.). It will be run in two sections; the first, a start from zero, from 0 to 1.0 ms; and the second, a restart, from 1.0 ms. to 2.0 ms. The time increment (TAU1/ENT1) was chosen as .1 ms, and the convergence criterion was chosen as .01, meaning that the pressure at the last iteration should be within 1% of that of the previous iteration.

Sample input sheets for the start from zero are shown below.

The symbols have the following meaning:

NSTART	0 for a start from zero
	1 for a restart
NSAVE	0 when no data will be saved
	1 when data will be saved for a future restart
NINT	Total no. of time intervals already computed:
	(= 0 for a start from zero)
KODER2 KODES2	Tape codes (See Section 3. 1)
RHO	Mass density of fluid in lbs. /cu. ft.
WT	Weight of vehicle in lbs.
INDER	Always = 1
CONV	Convergence criterion (see Section 1. 3)
IVX	Maximum allowable no. of iterations per time
	cycle (see Section 1. 3)
ICYL	= 0, always

All other symbols have been discussed in Section 4.

EDPM JOB REQUEST SUPPLEMENT

JOB NO.	REQUESTED BY	PHONE

ADDITIONAL INSTRUCTIONS

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 8

PUT FILE RING IN

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 9

PUT FILE RING IN

☐ SEE BACK OF FORM

TAPE USAGE

AUTH NO. _____ NAME _____

JOB NO. _____ DATE _____

PHONE _____ DEPT _____ GROUP _____

UNIT	REEL NO.	TA. [illegible]	DESCRIPTION	MINIMUM LENGTH	RESERVE THIS TAPE	FILE THIS TAPE	RETURN WITHDRAWN TAPE	RELEASE RESERVE TAPE	WITHDRAW UNRESERVED TAPE	WITHDRAW RESERVED TAPE
8	A	10	Saved data at 1.0 ms.		✓					
9	B	11	Response 0 - 1.0 ms.		✓					

FORM 114-A-11

Start from zero time and run at
increment t = .1 ms to 1.0 ms.

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	0		NSTART
13	1		NSAVE
25	0		NINT
37	0		KODER2
49	1	73 80	KODES2
61			
1	T I T L E		
13			
25			
37			
49		73 80	
61			
1	T I T L E		
13			
25			
37			
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION (73–80)	DESCRIPTION DO NOT KEY PUNCH
1	TITLE		
13			
25			
37			
49			
61			
1	625.		RHO
13	100000.0		WT
25			
37			
49			
61			
1	1		INDER
13	0.01		CONV
25	25		IVX
37	0		ICYL
49			
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER _____ DATE_____ PAGE_____of_____

	NUMBER	IDENTIFICATION (73–80)	DESCRIPTION DO NOT KEY PUNCH
1	2		
13	1.		AO
25	1.		HO
37	1.		EO
49	1.		SIGO
61			
1	7		
13			
25	0.33		POI
37			
49			
61			
1	16		
13	1.0 -3		TAU1
25	10.		ENT1
37	1.		PI1
49			
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	2 1		
13			
25			
37			
49		73 80	
61	.9 7 5 - 3		MASS
1	3 0		
13	- 1 .		SUM
25			
37			
49		73 80	
61			
1	3 3		
13	- 1 .		TFI
25	3 6 0 .		VIN
37			
49	0 . 0	73 80	RESTRT
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	— 4476		
13	1.0 +10		EM1N
25	3.0		EM3N
37			
49		73 80	
61			
1	1		GDA
13	2.0		GMI
25	120.0		EN
37	-1.0		PFLAG
49	175.6	73 80	RC
61	0.0		ROFF
1	— 6		
13	0.0		PHIC
25	19.530		PHIN
37			
49		73 80	
61			

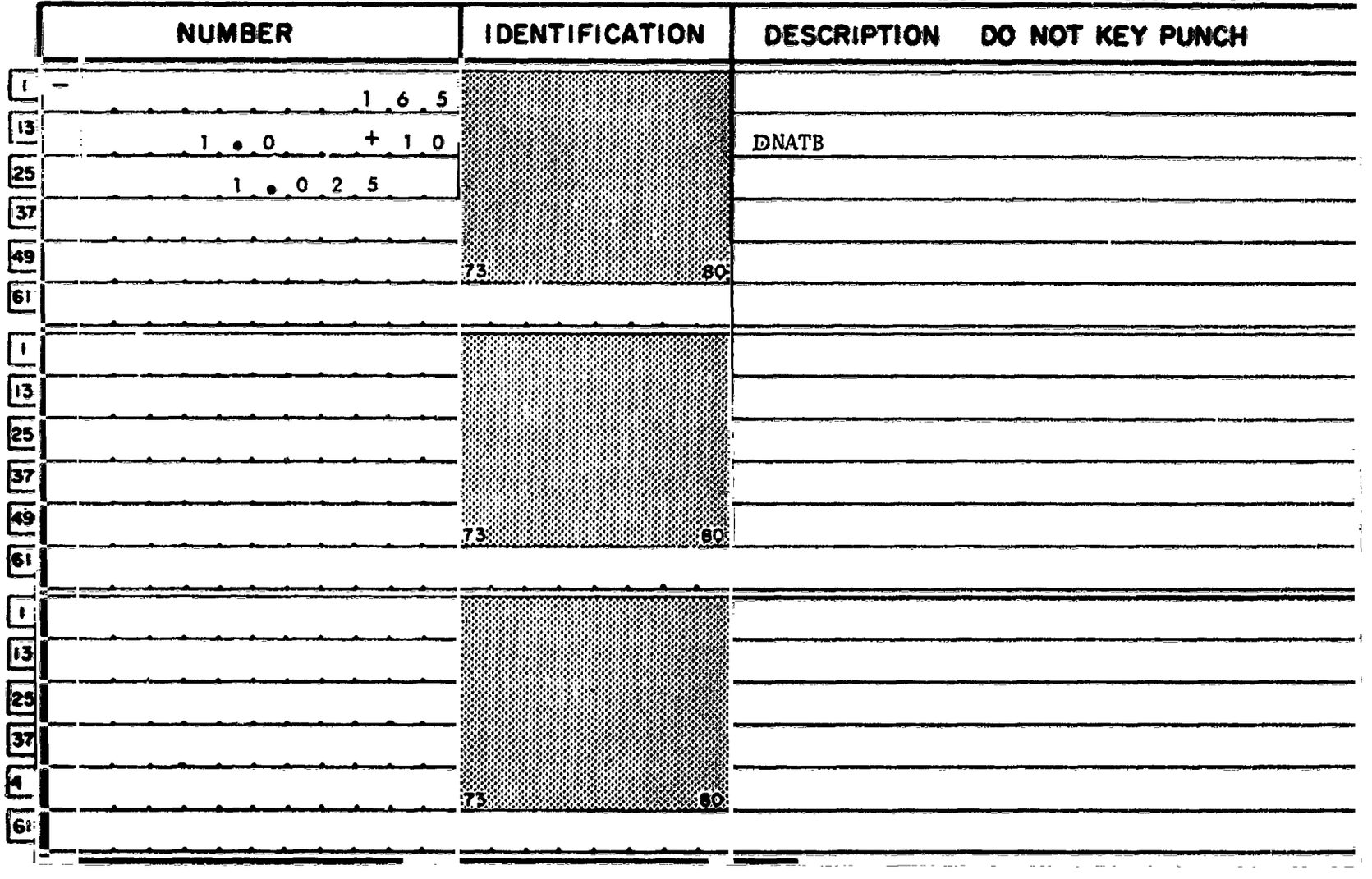
FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	1	73 80	CDA
13	1 • 0 +10		DTB
25	3 • 3 3 +6		
37			
49			
61			
1	4 2		
13	1 • 0 +10		EKTB
25	3 • 3 3 +6		
37			
49		73 80	
61			
1	8 3		
13	1 • 0 +10		EITB
25	2 9 • 7 +6		
37			
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____



5.3 Sample Data and Tape Usage for the Restart

In order to restart the problem at 1.0 ms., the following input is required. Note that the time interval must be the same in all runs.

The output quantities will be identical to those from the start from zero.

EDPM JOB REQUEST SUPPLEMENT

JOB NO.	REQUESTED BY	PHONE

ADDITIONAL INSTRUCTIONS

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 8
PUT FILE RING IN

MOUNT ANY AVAILABLE TAPE ON LOGICAL UNIT 9
PUT FILE RING IN

MOUNT TAPE A ON LOGICAL UNIT 12

MOUNT TAPE B ON LOGICAL UNIT 13

☐ SEE BACK OF FORM

TAPE USAGE

AUTH NO. _____ NAME _____
JOB NO. _____ DATE _____
PHONE _____ DEPT _____ GROUP _____

UNIT	REEL NO.	TAPE ID	DESCRIPTION	MINIMUM LENGTH	RESERVE THIS TAPE	FILE THIS TAPE	RETURN WITHDRAWN TAPE	RELEASE RESERVE TAPE	WITHDRAW UNRESERVED TAPE	WITHDRAW RESERVED TAPE
8	C	20	Saved data at 2.0 ms		✓					
9	D	21	Response 0 - 2.0 ms		✓					
12	A	10	Saved data at 1.0 ms					✓		
13	B	11	Response 0 - 1.0 ms					✓		

FORM 114-A-11

Restart to run from 1.0 to 2.0

FORTRAN FIXED 10 DIGIT DECIMAL DATA

Changes are denoted by
ar

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	1	73 80	NSTART ←
13	1		NSAVE
25	10		NINT ←
37	10		KODER2 ←
49	11		KODES2 ←
61			
1	TITLE		←
13			
25			
37			
49		73 80	
61			
1	TITLE		
13			←
25			
37			
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER _____ DATE _____ PAGE_____of_____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	TITLE		←
13			
25			
37			
49		73 80	
61			
1	625		RHO Same
13	100000.0		WT
25			
37			
49		73 80	
61			
1	1		INDER Same
13	0.01		CONV
25	25		IVX
37	0		ICYL
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	2		Same
13	1.		AO
25	1.		HO
37	1.		EO
49	1.	73 80	SIGO
61	0.0		INFO
1	7		Same
13	0.0		ENFL
25	0.33		POI
37	0.0		THETA
49	0.0	73 80	PIXI
61			
1	16		
13	2.0 -3		TAU1 ←
25	20.		ENTI ←
37	1.		PI1
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION (73–80)	DESCRIPTION DO NOT KEY PUNCH
1	21		Same
13			
25			
37			
49			
61	.975 −3		MASS
1	30		Same
13	−1.		SUM
25			
37			
49			
61			
1	33		
13	−1.		TFI
25	360.		VIN
37			
49	10		RESTRT ←
61	0		PUNCH

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	4476		Same
13	1.0 +10		EM1N
25	3.0		EM3N
37			
49		73 80	
61			
1	1		Same
13	2.0		GMI
25	1200.0		EN
37	-1.0		PFLAG
49	175.6	73 80	RA1, RC
61	.00		AXL, ROFF
1	6		Same
13	0.0		ANX, PHIO
25	19.530		PHIN
37			
49		73 80	
61			

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1		Same
1.0 +10		DTB
3.33 +6		
	73 80	
42		Same
1.0 +10		EKTB
3 33 6		
	73 80	
83		Same
1.0 +10		EITB
29.7 +6		
	73 80	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE _____ of _____

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	1.65	73 80	Same
13	1.0 +10		DMATB
25	1.025		
37			
49			
61			
1			
13			
25			
37			
49		73	
61			
1			
13			
25			
37			
49		73 80	
61			

5.4 Sample Output

The following pages show the output resulting from the start from zero of the sample problem. Letters in circles correspond to descriptions below.

(A) First Title Card

(B) Second Title card

(C) Third Title card

(D) No. of Stations EN

(E) Radius of curvature, ins.

(F) Offset distance from cente- of curvature = 0

(G) Closed apex, therefore PHIO initial opening angle is zero

(H) PHIN, final opening angle is 19.53°

(I) Station number

(J) R(I), normal distance from shell to axis

(K) W(THETA) nondimensional curvature in θ direction

(L) W(XI) nondimensional curvature in ξ direction

(M) RHOX(I) $R(I)/AO = \rho/AO$

(N) GAMMA (I) ρ'/ρ

(O) DTB, the extensional rigidity (constant over shell)

(P) EKTB, the flexural rigidity (constant over shell)

(Q) EITB, the Young's modulus (constant over shell)

(R) ALFTB, thermal expansion coefficient (zero)

(S) DNATB, 1/2 shell thickness (constant over shell)

(T) TTB, temperature gradient (zero)

(U) ENTB, membrane thermal load (zero)

(V) EMTB, bending thermal load (zero)

(W) All these other quantities, read by CDR, are set to zero.

(X) See Sections 4.4 to 4.7 for descriptions

EN = number of stations

AO = reference length

HO = Reference thickness

EO = Reference Young's modulus

SIGO = Reference stress level

ENFO = always zero

ENFL = always zero

POI = Poisson's ratio

THETA = always zero

PIXI = always zero

SPRL = location of spring along meridian

UK = spring value in ξ direction

VK = always zero

WK = spring value in normal direction

EMK = always zero

TAU1 = total length of time from zero

ENTI = Total no. of time intervals from zero to TAU1

PI1 = point interval. Here PI1 = 1, and output is pointed at end of each interval

TAU2 = 0
ENT2 = 0
PI2 = 0
TAU3 = 0
ENT3 = 0
PI3 = 0
} (always zero)

MASS = mass density

CFE = coefficient of viscous damping at each station in ξ direction

CZ = coefficient of viscous damping at each station in normal direction.

SKFE = spring constant of shell under elastic restraint in ξ direction

SUM = -1. always

EN1 = 1., open shell; = 2., closed shell; set in GEOM

DEL = distance between station points

BCITP = boundary condition indicator - top boundary

BCIBM = boundary condition indicator - bottom boundary

(Y) Full Tables of

D Extensional rigidity

EK Flexural rigidity

E1 Young's modulus

ALF Coefficient of thermal expansion (zero here)

DNA . 1/2 shell thickness

T temperature gradient through shell (zero here)

ENT membrane thermal load (zero here)

EMT Bending thermal load (zero here)

(Z) Full Tables of

PN, PFE, DZO, VZO, AZO, DFO, VFO, AFO, all of which were read as zero in CDA. [See Section 4.7 for their descriptions].

(AA) This page is a diagnostic output which is made during each cycle in order to check the manner in which the iterations (described in Section 1.3) are made. Each row is denoted by a numeral in a circle (1) to (10). Column (AB) denotes the pressure component at the apex computed from the second term (the summation) of Equation 1 of Section 1.3.

Column (AC) denotes an intermediate average pressure at the apex derived from Column (AB) during each iteration. Column (AD) denotes the total pressure at the apex of the shell after each iteration. Column (AE) denotes the velocity of the shell after each iteration.

Element [(AE), (1)] is zero because this is the first calculation from an initial condition of zero. Rows (2) through (10) follow from each individual iteration. It is seen that for this time cycle there are a total of 9 iterations.

(BA) is self-explanatory. It shows the time (t), maximum radius of the pressure profile (c), overall vehicle velocity (V), overall acceleration of the center of gravity (A), and depth of penetration (b).

(BB) is a column showing the station number from the apex (1) to the boundary (120).

(BC) is a column of the total pressure acting at each station point. Because the maximum radius of the wetted surface is 3.56 ins., and the distance between each station point (DEL, see (X)) is .503 ins., the wetted surface only extends to station 8. Beyond this station, no pressure is applied. Note that the maximum pressure always occurs at the edge of the wetted surface, in this case at station 8.

(BD) is a column of pressures derived from the first term of Equation 1 of Section 1.3. Because they depend only on the overall velocity v, they have been here called the rigid-body components of pressure.

(BE) is a column of pressures derived from the second term of Equation 1 of Section 1.3. They are called the elastic components because they also depend on the structural velocities.

(CA) This page contains columns of response output. The columns are as follows:

I	Station points along shell meridian
U(I)	Tangential displacement (ins) of middle surface in ξ direction
V(I)	Tangential displacement of middle surface in θ direction. Here zero because problem is axially symmetric.
W(I)	Transverse displacement (ins.) of middle surface (positive outward).
M(PHI)	Meridional bending moment M_ξ (in lbs/in.)
M(THETA)	Circumferential bending moment M_θ (in lbs/in.)
M(PHI, THETA)	Twisting moment $M_{\xi\theta}$. Zero here because problem is axially symmetric.
Q(PHI)	Shear force Q_ξ (lbs/in.)
Q(THETA)	Shear force Q_θ. Zero here because problem is axially symmetric.
(DA)	Additional columns of response.
I	Station point along meridian
N(PHI)	Meridional membrane force N_ξ (lbs/in.)
N(THETA)	Circumferential membrane force N_θ (lbs/in.)
N(PHI, THETA)	Twisting force $N_{\xi\theta}$. Zero here because problem is axially symmetric.
SIG(PHI)	Stress σ_ξ (psi) on outer fiber of shell.
SIG(THETA)	Stress σ_θ (psi) on outer fiber of shell.
SIG(PHI, THETA)	Stress $\sigma_{\xi\theta}$ on outer fiber of shell. Zero here because problem is axisymmetric.
(EA)	Additional columns of response.

VEL(U)	Tangential velocity in ξ direction (ins. /sec.)
VEL(V)	Tangential velocity in θ direction. Zero here because problem is axially symmetric
VEL(W)	Transverse velocity (ins. /sec.), positive in outward direction.
ACC(U)	Tangential acceleration in ξ direction (ins. /sec.^{2})
ACC(V)	Tangential acceleration in θ direction (ins. /sec.^{2}).
ACC(W)	Transverse acceleration (ins. /sec.^{2}), positive in outward direction.
(FA)	The above output of the response quantities (AA) to (EA) is repeated with each time cycle. After a complete run these output quantities will be stored also on a tape as described in Section 3. 1. The appropriate KODES of each reserve tape are pointed at the end of all the output. In this case, the symbols have the following meanings. For a start from zero, see Table 2, for a restart, see Table 3.

KODE	ID	Tape Description
KODER1	10	Tape containing response at 1.0 ms
KODER2	0	Here a dummy tape
KODES1	1	Here a dummy tape
KODES2	11	Tape containing saved data for a restart

Table 2. KODES for a start from zero

KODE	ID	Tape Description
KODER1	10	Tape containing response at 1.0 ms.
KODER2	20	Tape containing response at 2.0 ms.
KODES1	11	Tape containing saved data at 1.0 ms.
KODES2	21	Tape containing saved data at 2.0 ms for a future restart.

Table 3. KODES for a restart

Ⓐ HYDROELASTIC RESPONSE APOLLO SPHERE ** FIXED BND.- P(N) IN ANALYTIC FORM

Ⓑ 5 ITERATIONS TO 0.5 MS ** POI=.33,EN=120., RHO=.000975

Ⓒ OPEN ANGLE=19.53, D=3.33E+6, K=3.33E+6, E=29.7E+6, DNA=1.025IN, RC=175.6

GEOMETRY DATA FOR REGION... (SPHERE - TOROID)

(D) NUMBER OF STATIONS - 120

(E) RC = 1.7560E 02 (F) ROFF = 0.0000E-39 (G) PHIO = 0.0000E-39 (H) PHIN = 1.9530E 01

(I) I	(J) R(I)	(K) W(THETA)	(L) W(XI)	(M) RHOX(I)	(N) GAMA(I)
1	0.0000000E-39	5.6947608E-03	5.6947608E-03	0.0000000E-39	1.0000000E 10
2	5.0298677E-01	5.6947608E-03	5.6947608E-03	5.0298677E-01	1.9881132E 00
3	1.0059694E 00	5.6947608E-03	5.6947608E-03	1.0059694E 00	9.9404847E-01
4	1.5089438E 00	5.6947608E-03	5.6947608E-03	1.5089438E 00	6.6268992E-01
5	2.0119058E 00	5.6947608E-03	5.6947608E-03	2.0119058E 00	4.9700793E-01
6	2.5148512E 00	5.6947608E-03	5.6947608E-03	2.5148512E 00	3.9759653E-01
7	3.0177760E 00	5.6947608E-03	5.6947608E-03	3.0177760E 00	3.3132047E-01
8	3.5206761E 00	5.6947608E-03	5.6947608E-03	3.5206761E 00	2.8397889E-01
9	4.0235473E 00	5.6947608E-03	5.6947608E-03	4.0235473E 00	2.4847133E-01
10	4.5263854E 00	5.6947608E-03	5.6947608E-03	4.5263854E 00	2.2085313E-01
11	5.0291864E 00	5.6947608E-03	5.6947608E-03	5.0291864E 00	1.9875748E-01
12	5.5319462E 00	5.6947608E-03	5.6947608E-03	5.5319462E 00	1.8067824E-01
13	6.0346605E 00	5.6947608E-03	5.6947608E-03	6.0346605E 00	1.6561129E-01
14	6.5373253E 00	5.6947608E-03	5.6947608E-03	6.5373253E 00	1.5286151E-01
15	7.0399365E 00	5.6947608E-03	5.6947608E-03	7.0399365E 00	1.4193236E-01
16	7.5424901E 00	5.6947608E-03	5.6947608E-03	7.5424901E 00	1.3245968E-01
17	8.0449816E 00	5.6947608E-03	5.6947608E-03	8.0449816E 00	1.2417040E-01
18	8.5474072E 00	5.6947608E-03	5.6947608E-03	8.5474072E 00	1.1685570E-01
19	9.0497625E 00	5.6947608E-03	5.6947608E-03	9.0497625E 00	1.1035314E-01
20	9.5520437E 00	5.6947608E-03	5.6947608E-03	9.5520437E 00	1.0453448E-01
21	1.0054246E 01	5.6947608E-03	5.6947608E-03	1.0054246E 01	9.9297155E-02
22	1.0556367E 01	5.6947608E-03	5.6947608E-03	1.0556367E 01	9.4558103E-02
23	1.1058400E 01	5.6947608E-03	5.6947608E-03	1.1058400E 01	9.0249382E-02
24	1.1560343E 01	5.6947608E-03	5.6947608E-03	1.1560343E 01	8.6314849E-02
25	1.2062191E 01	5.6947608E-03	5.6947608E-03	1.2062191E 01	8.2707722E-02
26	1.2563940E 01	5.6947608E-03	5.6947608E-03	1.2563940E 01	7.9388759E-02
27	1.3065586E 01	5.6947608E-03	5.6947608E-03	1.3065586E 01	7.6324672E-02
28	1.3567125E 01	5.6947608E-03	5.6947608E-03	1.3567125E 01	7.3487151E-02
29	1.4068553E 01	5.6947608E-03	5.6947608E-03	1.4068553E 01	7.0851913E-02
30	1.4569865E 01	5.6947608E-03	5.6947608E-03	1.4569865E 01	6.8398048E-02
31	1.5071057E 01	5.6947608E-03	5.6947608E-03	1.5071057E 01	6.6107434E-02
32	1.5572126E 01	5.6947608E-03	5.6947608E-03	1.5572126E 01	6.3964210E-02
33	1.6073067E 01	5.6947608E-03	5.6947608E-03	1.6073067E 01	6.1954599E-02
34	1.6573876E 01	5.6947608E-03	5.6947608E-03	1.6573876E 01	6.0066465E-02
35	1.7074549E 01	5.6947608E-03	5.6947608E-03	1.7074549E 01	5.8289090E-02

36	1.7575083E 01	5.6947608E-03	5.6947608E-03	1.7575083E 01	5.6612959E-02
37	1.8075472E 01	5.6947608E-03	5.6947608E-03	1.8075472E 01	5.5029624E-02
38	1.8575712E 01	5.6947608E-03	5.6947608E-03	1.8575712E 01	5.3531597E-02
39	1.9075800E 01	5.6947608E-03	5.6947608E-03	1.9075800E 01	5.2112132E-02
40	1.9575732E 01	5.6947608E-03	5.6947608E-03	1.9575732E 01	5.0765160E-02
41	2.0075503E 01	5.6947608E-03	5.6947608E-03	2.0075503E 01	4.9485280E-02
42	2.0575110E 01	5.6947608E-03	5.6947608E-03	2.0575110E 01	4.8267571E-02
43	2.1074547E 01	5.6947608E-03	5.6947608E-03	2.1074547E 01	4.7107559E-02
44	2.1573812E 01	5.6947608E-03	5.6947608E-03	2.1573812E 01	4.6001273E-02
45	2.2072900E 01	5.6947608E-03	5.6947608E-03	2.2072900E 01	4.4945026E-02
46	2.2571806E 01	5.6947608E-03	5.6947608E-03	2.2571806E 01	4.3935454E-02
47	2.3070527E 01	5.6947608E-03	5.6947608E-03	2.3070527E 01	4.2969562E-02
48	2.3569060E 01	5.6947608E-03	5.6947608E-03	2.3569060E 01	4.2044541E-02
49	2.4067398E 01	5.6947608E-03	5.6947608E-03	2.4067398E 01	4.1157818E-02
50	2.4565540E 01	5.6947608E-03	5.6947608E-03	2.4565540E 01	4.0307058E-02
51	2.5063479E 01	5.6947608E-03	5.6947608E-03	2.5063479E 01	3.9490103E-02
52	2.5561213E 01	5.6947608E-03	5.6947608E-03	2.5561213E 01	3.8705000E-02
53	2.6058737E 01	5.6947608E-03	5.6947608E-03	2.6058737E 01	3.7949885E-02
54	2.6556047E 01	5.6947608E-03	5.6947608E-03	2.6556047E 01	3.7223042E-02
55	2.7053140E 01	5.6947608E-03	5.6947608E-03	2.7053140E 01	3.6522899E-02
56	2.7550010E 01	5.6947608E-03	5.6947608E-03	2.7550010E 01	3.5848037E-02
57	2.8046654E 01	5.6947608E-03	5.6947608E-03	2.8046654E 01	3.5197090E-02
58	2.8543068E 01	5.6947608E-03	5.6947608E-03	2.8543068E 01	3.4568784E-02
59	2.9039249E 01	5.6947608E-03	5.6947608E-03	2.9039249E 01	3.3961948E-02
60	2.9535190E 01	5.6947608E-03	5.6947608E-03	2.9535190E 01	3.3375504E-02
61	3.0030890E 01	5.6947608E-03	5.6947608E-03	3.0030890E 01	3.2808419E-02
62	3.0526343E 01	5.6947608E-03	5.6947608E-03	3.0526343E 01	3.2259739E-02
63	3.1021546E 01	5.6947608E-03	5.6947608E-03	3.1021546E 01	3.1728597E-02
64	3.1516494E 01	5.6947608E-03	5.6947608E-03	3.1516494E 01	3.1214120E-02
65	3.2011183E 01	5.6947608E-03	5.6947608E-03	3.2011183E 01	3.0715557E-02
66	3.2505610E 01	5.6947608E-03	5.6947608E-03	3.2505610E 01	3.0232179E-02
67	3.2999770E 01	5.6947608E-03	5.6947608E-03	3.2999770E 01	2.9763259E-02
68	3.3493659E 01	5.6947608E-03	5.6947608E-03	3.3493659E 01	2.9308202E-02
69	3.3987274E 01	5.6947608E-03	5.6947608E-03	3.3987274E 01	2.8866366E-02
70	3.4480610E 01	5.6947608E-03	5.6947608E-03	3.4480610E 01	2.8437149E-02
71	3.4973663E 01	5.6947608E-03	5.6947608E-03	3.4973663E 01	2.8020037E-02
72	3.5466428E 01	5.6947608E-03	5.6947608E-03	3.5466428E 01	2.7614533E-02
73	3.5958903E 01	5.6947608E-03	5.6947608E-03	3.5958903E 01	2.7220150E-02
74	3.6451083E 01	5.6947608E-03	5.6947608E-03	3.6451083E 01	2.6836408E-02
75	3.6942964E 01	5.6947608E-03	5.6947608E-03	3.6942964E 01	2.6462874E-02
76	3.7434541E 01	5.6947608E-03	5.6947608E-03	3.7434541E 01	2.6099165E-02
77	3.7925812E 01	5.6947608E-03	5.6947608E-03	3.7925812E 01	2.5744906E-02
78	3.8416771E 01	5.6947608E-03	5.6947608E-03	3.8416771E 01	2.5399677E-02

79	3.8907415E 01	5.6947608E-03	5.6947608E-03	3.8907415E 01	2.5063158E-02
80	3.9397740E 01	5.6947608E-03	5.6947608E-03	3.9397740E 01	2.4735016E-02
81	3.9887742E 01	5.6947608E-03	5.6947608E-03	3.9887742E 01	2.4414950E-02
82	4.0377416E 01	5.6947608E-03	5.6947608E-03	4.0377416E 01	2.4102658E-02
83	4.0866759E 01	5.6947608E-03	5.6947608E-03	4.0866759E 01	2.3797824E-02
84	4.1355767E 01	5.6947608E-03	5.6947608E-03	4.1355767E 01	2.3500199E-02
85	4.1844435E 01	5.6947608E-03	5.6947608E-03	4.1844435E 01	2.3209560E-02
86	4.2332760E 01	5.6947608E-03	5.6947608E-03	4.2332760E 01	2.2925626E-02
87	4.2820738E 01	5.6947608E-03	5.6947608E-03	4.2820738E 01	2.2648142E-02
88	4.3308365E 01	5.6947608E-03	5.6947608E-03	4.3308365E 01	2.2376895E-02
89	4.3795635E 01	5.6947608E-03	5.6947608E-03	4.3795635E 01	2.2111716E-02
90	4.4282547E 01	5.6947608E-03	5.6947608E-03	4.4282547E 01	2.1852390E-02
91	4.4769096E 01	5.6947608E-03	5.6947608E-03	4.4769096E 01	2.1598657E-02
92	4.5255277E 01	5.6947608E-03	5.6947608E-03	4.5255277E 01	2.1350387E-02
93	4.5741087E 01	5.6947608E-03	5.6947608E-03	4.5741087E 01	2.1107409E-02
94	4.6226521E 01	5.6947608E-03	5.6947608E-03	4.6226521E 01	2.0869534E-02
95	4.6711577E 01	5.6947608E-03	5.6947608E-03	4.6711577E 01	2.0636598E-02
96	4.7196249E 01	5.6947608E-03	5.6947608E-03	4.7196249E 01	2.0408445E-02
97	4.7680534E 01	5.6947608E-03	5.6947608E-03	4.7680534E 01	2.0184935E-02
98	4.8164428E 01	5.6947608E-03	5.6947608E-03	4.8164428E 01	1.9965885E-02
99	4.8647925E 01	5.6947608E-03	5.6947608E-03	4.8647925E 01	1.9751217E-02
100	4.9131024E 01	5.6947608E-03	5.6947608E-03	4.9131024E 01	1.9540797E-02
101	4.9613720E 01	5.6947608E-03	5.6947608E-03	4.9613720E 01	1.9334451E-02
102	5.0096010E 01	5.6947608E-03	5.6947608E-03	5.0096010E 01	1.9132085E-02
103	5.0577888E 01	5.6947608E-03	5.6947608E-03	5.0577888E 01	1.8933564E-02
104	5.1059351E 01	5.6947608E-03	5.6947608E-03	5.1059351E 01	1.8738803E-02
105	5.1540396E 01	5.6947608E-03	5.6947608E-03	5.1540396E 01	1.8547656E-02
106	5.2021016E 01	5.6947608E-03	5.6947608E-03	5.2021016E 01	1.8360049E-02
107	5.2501211E 01	5.6947608E-03	5.6947608E-03	5.2501211E 01	1.8175906E-02
108	5.2980975E 01	5.6947608E-03	5.6947608E-03	5.2980975E 01	1.7995078E-02
109	5.3460304E 01	5.6947608E-03	5.6947608E-03	5.3460304E 01	1.7817498E-02
110	5.3939195E 01	5.6947608E-03	5.6947608E-03	5.3939195E 01	1.7643060E-02
111	5.4417642E 01	5.6947608E-03	5.6947608E-03	5.4417642E 01	1.7471686E-02
112	5.4895643E 01	5.6947608E-03	5.6947608E-03	5.4895643E 01	1.7303327E-02
113	5.5373195E 01	5.6947608E-03	5.6947608E-03	5.5373195E 01	1.7137860E-02
114	5.5850291E 01	5.6947608E-03	5.6947608E-03	5.5850291E 01	1.6975209E-02
115	5.6326930E 01	5.6947608E-03	5.6947608E-03	5.6326930E 01	1.6815315E-02
116	5.6803105E 01	5.6947608E-03	5.6947608E-03	5.6803105E 01	1.6658115E-02
117	5.7278816E 01	5.6947608E-03	5.6947608E-03	5.7278816E 01	1.6503547E-02
118	5.7754057E 01	5.6947608E-03	5.6947608E-03	5.7754057E 01	1.6351485E-02
119	5.8228823E 01	5.6947608E-03	5.6947608E-03	5.8228823E 01	1.6201908E-02
120	5.8703112E 01	5.6947608E-03	5.6947608E-03	5.8703112E 01	1.6054856E-02

CURVE FIT TABLES

	DTB	FKTB	EITB	ALFTB	DNATB	TTB	ENTB	EMTB
1	1.000E 10	1.000E 10	1.000E 10	0.000E-39	1.000E 10	0.000E-39	0.000E-39	0.000E-39
2	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
3	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
4	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
5	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
6	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
7	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
8	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
9	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
10	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
11	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
12	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
13	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
14	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
15	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
16	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
17	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
18	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
19	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
20	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
21	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
22	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
23	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
24	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
25	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
26	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
27	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
28	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
29	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
30	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
31	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
32	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
33	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
34	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
35	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
36	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39

37	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
38	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
40	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39
41	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39	0.000E-39

(W)	PNTB	PFETB	PTHTB	DZOTB	VZOTB	QZOTB	DFOTB	VFOTB	QFOTB
1	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
2	0.00E-3	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
3	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
4	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
5	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
6	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
7	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
8	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
9	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
10	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
11	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
12	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
13	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
14	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
15	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
16	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
17	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
18	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
19	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
20	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
21	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
22	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
23	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
24	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
25	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
26	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
27	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
28	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
29	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
30	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
31	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
32	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
33	0.0[illegible]-39	0.00E-39	0.00E-39	0.00E-39	0.[illegible]E-39	0.00E-39	0.00E-39	0.00E-39	[illegible]00E-39

34	0.00E-39	0.00E-39	0.00F-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
35	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
36	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
37	0.00E-39	0.00E-39	0.00E-39	0.00F-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
38	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
39	0.00E-39	0.00E-39	0.00F-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
40	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00F-39	0.00E-39	0.00E-39
41	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00F-39	0.00E-39

(X) INITIAL DATA

EN =	1.200E 02	AO =	1.000E 00	HO =	1.000E 00	EO =	1.000E 00
SIGO =	1.000E 00	ENFO =	0.000E-39	ENFL =	0.000E-39	PDI =	3.300E-01
THETA =	0.000E-39	PIXI =	0.000E-39	SPRL =	0.000E-39	UK =	0.000E-39
VK =	0.000E-39	WK =	0.000E-39	EMK =	0.000E-39	TAU1 =	5.000E-04
ENT1 =	5.000E 00	PI1 =	1.000E 00	TAU2 =	0.000E-39	ENT2 =	0.000E-39
PI2 =	0.000E-39	TAU3 =	0.000E-39	ENT3 =	0.000E-39	PI3 =	0.000E-39
MASS =	9.750E-04	CFE =	0.000E-39	CZ =	0.000E-39	SKFE =	0.000E-39
SKZ =	0.000E-39	SUM =	-1.000E 00	EN1 =	2.000E 00	DEL =	5.030E-01
BCITP =	0.000E-39	BCIBM =	3.000E 00				

(Y)

	D	EK	F1	ALF	DNA	T	ENT	EMT
1	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
2	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
3	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
4	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
5	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
6	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
7	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
8	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
9	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
10	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
11	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
12	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
13	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
14	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
15	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
16	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
17	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
18	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
19	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39

20	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
21	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
22	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
23	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
24	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
25	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
26	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
27	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
28	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
29	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
30	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
31	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
32	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
33	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
34	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
35	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
36	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
37	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
38	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
39	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
40	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
41	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
42	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
43	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
44	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
45	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
46	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
47	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
48	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
49	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
50	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
51	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
52	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
53	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
54	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
55	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
56	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
57	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
58	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
59	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
60	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
61	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
62	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39

63	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
64	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
65	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
66	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
67	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
68	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
69	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
70	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
71	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
72	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
73	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
74	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
75	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
76	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
77	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
78	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
79	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
80	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
81	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
82	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
83	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
84	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
85	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
86	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
87	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
88	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
89	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
90	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
91	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
92	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
93	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
94	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
95	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
96	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
97	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
98	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
99	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
100	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
101	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
102	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
103	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
104	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
105	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39

106	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
107	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
108	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
109	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
110	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
111	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
112	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
113	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
114	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
115	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
116	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
117	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
118	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
119	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39
120	3.330E 06	3.330E 06	2.970E 07	0.000E-39	1.025E 00	0.000E-39	0.000E-39	0.000E-39

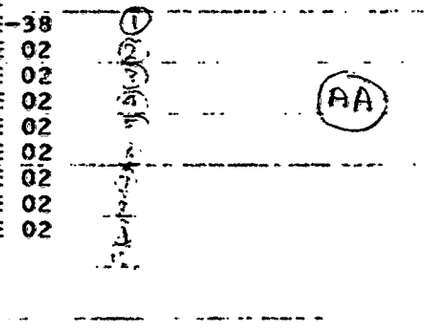
	PN	PFE	PTH	DZO	VZO	AZO	DFO	VFO	AFO
1	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
2	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
3	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
4	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
5	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
6	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
7	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
8	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
9	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
10	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
11	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
12	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
13	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
14	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
15	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
16	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
17	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
18	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
19	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
20	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
21	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
22	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
23	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39

24	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
25	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
26	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
27	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
28	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
29	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
30	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
31	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
32	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
33	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
34	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
35	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
36	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
37	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
38	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
40	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
41	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
42	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
43	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
44	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
45	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
46	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
47	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
48	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
49	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
50	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
51	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
52	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
53	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
54	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
55	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
56	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
57	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
58	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
59	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
60	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
61	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
62	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
63	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
64	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
65	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
66	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39

67	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
68	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
69	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
70	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
71	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
72	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
73	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
74	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
75	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
76	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
77	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
78	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
79	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
80	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
81	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
82	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
83	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
84	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
85	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
86	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
87	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
88	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
89	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
90	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
91	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
92	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
93	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
94	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
95	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
96	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
97	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
98	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
99	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
100	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
101	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
102	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
103	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
104	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
105	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
106	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
107	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
108	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
109	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39

110	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
111	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
112	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
113	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
114	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
115	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
116	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
117	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
118	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
119	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39
120	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39	0.00E-39

(AB) EL PRES	(AC) AV EL PRES	(AD) TOT PRES	(AE) SHELL VEL
0.00000E-38	0.00000E-38	-0.38140E 03	0.00000E-38
0.15770E 03	0.78851E 02	-0.30255E 03	-0.53046E 02
0.13935E 03	0.99019E 02	-0.28238E 03	-0.46794E 02
0.13465E 03	0.10793E 03	-0.27347E 03	-0.45191E 02
0.13257E 03	0.11285E 03	-0.26855E 03	-0.44482E 02
0.13141E 03	0.11595E 03	-0.26545E 03	-0.44089E 02
0.13069E 03	0.11805E 03	-0.26335E 03	-0.43843E 02
0.13020E 03	0.11957E 03	-0.26183E 03	-0.43674E 02
0.12984E 03	0.12071E 03	-0.26069E 03	-0.43553E 02



WATER IMPACT PRESSURE LOADS

TIME = 0.10000000E-03SEC

MAX RAD OF PRESSURE PROFILE = 0.35557278E 01INS

VEHICLE VELOCITY = 0.36000000E 03INS/SEC

VEHICLE ACCELERATION = 0.00000000E-38G

DEPTH OF PENETRATION = 0.36000000E-01INS

STATION	TOTAL PRESSURE	RIGID-BODY COMPONENT	ELASTIC COMPONENT
1	-0.2607E 03	-0.3814E 03	0.1207E 03
2	-0.2651E 03	-0.3853E 03	0.1202E 03
3	-0.2790E 03	-0.3976E 03	0.1187E 03
4	-0.3050E 03	-0.4212E 03	0.1162E 03
5	-0.3495E 03	-0.4626E 03	0.1131E 03
6	-0.4295E 03	-0.5395E 03	0.1100E 03
7	-0.6099E 03	-0.7212E 03	0.1113E 03
8	-0.9771E 03	-0.1090E 04	0.1127E 03
9	0.0000E-38	.....	.....
10	0.0000E-38	.....	.....
11	0.0000E-38		
12	0.0000E-38		
13	0.0000E-38		
14	0.0000E-38		
15	0.0000E-38		
16	0.0000E-38		
17	0.0000E-38		
18	0.0000E-38		
19	0.0000E-38		
20	0.0000E-38		
21	0.0000E-38		
22	0.0000E-38		
23	0.0000E-38		
24	0.0000E-38		

25	0.0000E-38
26	0.0000E-38
27	0.0000E-38
28	0.0000E-38
29	0.0000E-38
30	0.0000E-38
31	0.0000E-38
32	0.0000E-38
33	0.0000F-38
34	0.0000E-38
35	0.0000E-38
36	0.0000E-38
37	0.0000E-38
38	0.0000E-38
39	0.0000E-38
40	0.0000E-38
41	0.0000E-38
42	0.0000E-38
43	0.0000E-38
44	0.0000E-38
45	0.0000E-38
46	0.0000E-38
47	0.0000E-38
48	0.0000E-38
49	0.0000E-38
50	0.0000E-38
51	0.0000E-38
52	0.0000E-38
53	0.0000E-38
54	0.0000E-38
55	0.0000E-38
56	0.0000E-38
57	0.0000E-38
58	0.0000E-38
59	0.0000E-38
60	0.0000E-38
61	0.0000E-38
62	0.0000E-38
63	0.0000E-38
64	0.0000E-38
65	0.0000E-38
66	0.0000E-38
67	0.0000E-38

68	0.0000E-38
69	0.0000E-38
70	0.0000E-38
71	0.0000E-38
72	0.0000E-38
73	0.0000E-38
74	0.0000E-38
75	0.0000E-38
76	0.0000E-38
77	0.0000E-38
78	0.0000E-38
79	0.0000E-38
80	0.0000E-38
81	0.0000E-38
82	0.0000E-38
83	0.0000E-38
84	0.0000E-38
85	0.0000E-38
86	0.0000E-38
87	0.0000E-38
88	0.0000E-38
89	0.0000E-38
90	0.0000E-38
91	0.0000E-38
92	0.0000E-38
93	0.0000E-38
94	0.0000E-38
95	0.0000E-38
96	0.0000E-38
97	0.0000E-38
98	0.0000E-38
99	0.0000E-38
100	0.0000E-38
101	0.0000E-38
102	0.0000E-38
103	0.0000E-38
104	0.0000E-38
105	0.0000E-38
106	0.0000E-38
107	0.0000E-38
108	0.0000E-38
109	0.0000E-38
110	0.0000E-38

111	0.0000E-38
112	0.0000E-38
113	0.0000E-38
114	0.0000E-38
115	0.0000E-38
116	0.0000E-38
117	0.0000E-38
118	0.0000E-38
119	0.0000E-38
120	0.0000E-38

UNDRFLOW AT 26463 IN MQ

DEFLECTIONS AND INTERNAL LOADS, TIME = 1.0000E-04

I	U(I)	V(I)	W(I)	M(PHI)	M(THETA)	M(PHI,THETA)	Q(PHI)	Q(THETA)
1	7.2760E-12	0.0000E-39	-4.3462E-03	-8.5440E 02	-8.5440E 02	-0.0000E-39	1.1021E 00	-0.0000E-39
2	6.5491E-06	0.0000E-39	-4.3218E-03	-8.5384E 02	-8.5384E 02	0.0000E-39	2.2229E 00	0.0000E-39
3	1.2993E-05	0.0000E-39	-4.2486E-03	-8.5215E 02	-8.5293E 02	0.0000E-39	8.6606E 00	0.0000E-39
4	1.9204E-05	0.0000E-39	-4.1268E-03	-8.4591E 02	-8.4965E 02	0.0000E-39	2.5065E 01	0.0000E-39
5	2.5056E-05	0.0000E-39	-3.9567E-03	-8.2944E 02	-8.4125E 02	0.0000E-39	5.8265E 01	0.0000E-39
6	3.0421E-05	0.0000E-39	-3.7395E-03	-7.9320E 02	-8.2310E 02	0.0000E-39	1.2033E 02	0.0000E-39
7	3.5163E-05	0.0000E-39	-3.4778E-03	-7.2035E 02	-7.8732E 02	0.0000E-39	2.4116E 02	0.0000E-39
8	3.9135E-05	0.0000E-39	-3.1769E-03	-5.7292E 02	-7.1705E 02	0.0000E-39	4.8400E 02	0.0000E-39
9	4.2169E-05	0.0000E-39	-2.8473E-03	-2.7462E 02	-5.7883E 02	0.0000E-39	5.8030E 02	0.0000E-39
10	4.4212E-05	0.0000E-39	-2.5106E-03	-6.5196E 01	-4.5537E 02	0.0000E-39	4.3917E 02	0.0000E-39
11	4.5360E-05	0.0000E-39	-2.1811E-03	8.0480E 01	-3.4985E 02	0.0000E-39	3.2842E 02	0.0000E-39
12	4.5722E-05	0.0000E-39	-1.8683E-03	1.7914E 02	-2.6208E 02	0.0000E-39	2.4092E 02	0.0000E-39
13	4.5410E-05	0.0000E-39	-1.5781E-03	2.4264E 02	-1.9055E 02	0.0000E-39	1.7174E 02	0.0000E-39
14	4.4534E-05	0.0000E-39	-1.3141E-03	2.7974E 02	-1.3328E 02	0.0000E-39	1.1726E 02	0.0000E-39
15	4.3200E-05	0.0000E-39	-1.0776E-03	2.9710E 02	-8.8277E 01	0.0000E-39	7.4706E 01	0.0000E-39
16	4.1506E-05	-0.0000E-39	-8.6890E-04	2.9988E 02	-5.3434E 01	0.0000E-39	4.1855E 01	0.0000E-39
17	3.9541E-05	-0.0000E-39	-6.8730E-04	2.9212E 02	-2.7138E 01	0.0000E-39	1.6916E 01	0.0000E-39
18	3.7385E-05	-0.0000E-39	-5.3138E-04	2.7701E 02	-7.7823E 00	0.0000E-39	-1.5930E 00	0.0000E-39
19	3.5106E-05	-0.0000E-39	-3.9931E-04	2.5704E 02	5.9848E 00	0.0000E-39	-1.4905E 01	0.0000E-39
20	3.2764E-05	-0.0000E-39	-2.8898E-04	2.3415E 02	1.5316E 01	0.0000E-39	-2.4051E 01	0.0000E-39
21	3.0409E-05	-0.0000E-39	-1.9820E-04	2.0983E 02	2.1182E 01	0.0000E-39	-2.9895E 01	0.0000E-39
22	2.8083E-05	-0.0000E-39	-1.2472E-04	1.8523E 02	2.4395E 01	0.0000E-39	-3.3156E 01	0.0000E-39
23	2.5816E-05	-0.0000E-39	-6.6349E-05	1.6118E 02	2.5620E 01	0.0000E-39	-3.4435E 01	0.0000E-39
24	2.3637E-05	-0.0000E-39	-2.1007E-05	1.3828E 02	2.5401E 01	0.0000E-39	-3.4227E 01	0.0000E-39
25	2.1562E-05	-0.0000E-39	1.3254E-05	1.1695E 02	2.4174E 01	0.0000E-39	-3.2940E 01	0.0000E-39
26	1.9605E-05	-0.0000E-39	3.8218E-05	9.7427E 01	2.2285E 01	0.0000E-39	-3.0903E 01	0.0000E-39
27	1.7776E-05	-0.0000E-39	5.5497E-05	7.9858E 01	2.0003E 01	0.0000E-39	-2.8381E 01	0.0000E-39
28	1.6077E-05	-0.0000E-39	6.6525E-05	6.4281E 01	1.7534E 01	0.0000E-39	-2.5585E 01	0.0000E-39
29	1.4512E-05	-0.0000E-39	7.2561E-05	5.0665E 01	1.5029E 01	0.0000E-39	-2.2676E 01	0.0000E-39
30	1.3076E-05	-0.0000E-39	7.4696E-05	3.8930E 01	1.2599E 01	0.0000E-39	-1.9777E 01	-0.0000E-39
31	1.1768E-05	0.0000E-39	7.3862E-05	2.8958E 01	1.0320E 01	-0.0000E-39	-1.6979E 01	-0.0000E-39
32	1.0581E-05	0.0000E-39	7.0847E-05	2.0609E 01	8.2390E 00	-0.0000E-39	-1.4347E 01	-0.0000E-39
33	9.5085E-06	0.0000E-39	6.6302E-05	1.3730E 01	6.3834E 00	-0.0000E-39	-1.1921E 01	-0.0000E-39
34	8.5440E-06	0.0000E-39	6.0764E-05	8.1595E 00	4.7638E 00	-0.0000E-39	-9.7263E 00	-0.0000E-39
35	7.6793E-06	0.0000E-39	5.4661E-05	3.7401E 00	3.3792E 00	-0.0000E-39	-7.7741E 00	-0.0000E-39
36	6.9063E-06	0.0000E-39	4.8333E-05	3.1777E-01	2.2196E 00	-0.0000E-39	-6.0649E 00	-0.0000E-39
37	6.2171E-06	0.0000E-39	4.2037E-05	-2.2527E 00	1.2695E 00	-0.0000E-39	-4.5913E 00	-0.0000E-39
38	5.6038E-06	0.0000E-39	3.5968E-05	-4.1060E 00	5.0960E-01	-0.0000E-39	-3.3407E 00	-0.0000E-39
39	5.059[illegible]-06	0.0000E-39	3.0261E-05	-5.3648E [illegible]	-8.1213E-02	-0.0000E-39	-2.2964E 00	[illegible].0000E-39

40	4.5755E-06	0.0000E-39	2.5008E-05	-6.1391E 00	-5.2472E-01	-0.0000E-39	-1.4396E 00	-0.0000E-39
41	4.1466E-06	0.0000E-39	2.0262E-05	-6.5263E 00	-8.4235E-01	-0.0000E-39	-7.5051E-01	-0.0000E-39
42	3.7662E-06	0.0000E-39	1.6048E-05	-6.6112E 00	-1.0545E 00	-0.0000E-39	-2.0881E-01	-0.0000E-39
43	3.4786E-06	0.0000E-39	1.2367E-05	-6.4666E 00	-1.1801E 00	-0.0000E-39	2.0518E-01	-0.0000E-39
44	3.1286E-06	0.0000E-39	9.2029E-06	-6.1542E 00	-1.2362E 00	-0.0000E-39	5.1022E-01	-0.0000E-39
45	2.8617E-06	0.0000E-39	6.5281E-06	-5.7257E 00	-1.2381E 00	-0.0000E-39	7.2380E-01	-0.0000E-39
46	2.6236E-06	0.0000E-39	4.3058E-06	-5.2232E 00	-1.1990E 00	-0.0000E-39	8.6190E-01	-0.0000E-39
47	2.4108E-06	0.0000E-39	2.4945E-06	-4.6808E 00	-1.1302E 00	-0.0000E-39	9.3887E-01	-0.0000E-39
48	2.2200E-06	0.0000E-39	1.0499E-06	-4.1252E 00	-1.0414E 00	-0.0000E-39	9.6740E-01	-0.0000E-39
49	2.0484E-06	0.0000E-39	-7.2758E-08	-3.5772E 00	-9.4020E-01	-0.0000E-39	9.5856E-01	-0.0000E-39
50	1.8935E-06	0.0000E-39	-9.1738E-07	-3.0518E 00	-8.3305E-01	-0.0000E-39	9.2183E-01	-0.0000E-39
51	1.7531E-06	0.0000E-39	-1.5257E-06	-2.5599E 00	-7.2488E-01	-0.0000E-39	8.6521E-01	-0.0000E-39
52	1.6254E-06	0.0000E-39	-1.9365E-06	-2.1085E 00	-6.1943E-01	-0.0000E-39	7.9535E-01	-0.0000E-39
53	1.5088E-06	0.0000E-39	-2.1853E-06	-1.7018E 00	-5.1948E-01	-0.0000E-39	7.1769E-01	-0.0000E-39
54	1.4020E-06	0.0000E-39	-2.3040E-06	-1.3414E 00	-4.2693E-01	-0.0000E-39	6.3655E-01	0.0000E-39
55	1.3039E-06	0.0000E-39	-2.3206E-06	-1.0272E 00	-3.4296E-01	0.0000E-39	5.5531E-01	0.0000E-39
56	1.2134E-06	-0.0000E-39	-2.2595E-06	-7.5763E-01	-2.6820E-01	0.0000E-39	4.7652E-01	0.0000E-39
57	1.1297E-06	-0.0000E-39	-2.1417E-06	-5.3017E-01	-2.0283E-01	0.0000E-39	4.0204E-01	0.0000E-39
58	1.0521E-06	-0.0000E-39	-1.9846E-06	-3.4160E-01	-1.4668E-01	0.0000E-39	3.3313E-01	0.0000E-39
59	9.7995E-07	-0.0000E-39	-1.8027E-06	-1.8827E-01	-9.9321E-02	0.0000E-39	2.7057E-01	0.0000E-39
60	9.1285E-07	-0.0000E-39	-1.6077E-06	-6.6368E-02	-6.0146E-02	0.0000E-39	2.1477E-01	0.0000E-39
61	8.5030E-07	-0.0000E-39	-1.4090E-06	2.7985E-02	-2.8435E-02	0.0000E-39	1.6580E-01	0.0000E-39
62	7.9194E-07	-0.0000E-39	-1.2136E-06	9.8561E-02	-3.4027E-03	0.0000E-39	1.2353E-01	0.0000E-39
63	7.3744E-07	-0.0000E-39	-1.0269E-06	1.4895E-01	1.5759E-02	0.0000E-39	8.7652E-02	0.0000E-39
64	6.8652E-07	-0.0000E-39	-8.5256E-07	1.8249E-01	2.9852E-02	0.0000E-39	5.7718E-02	0.0000E-39
65	6.3893E-07	-0.0000E-39	-6.9310E-07	2.0222E-01	3.9643E-02	0.0000E-39	3.3220E-02	0.0000E-39
66	5.9445E-07	-0.0000E-39	-5.4991E-07	2.1088E-01	4.5855E-02	0.0000E-39	1.3601E-02	0.0000E-39
67	5.5289E-07	-0.0000E-39	-4.2353E-07	2.1088E-01	4.9146E-02	0.0000E-39	-1.7104E-03	0.0000E-39
68	5.1406E-07	-0.0000E-39	-3.1386E-07	2.0432E-01	5.0111E-02	0.0000E-39	-1.3282E-02	0.0000E-39
69	4.7780E-07	-0.0000E-39	-2.2031E-07	1.9298E-01	4.9275E-02	0.0000E-39	-2.1657E-02	0.0000E-39
70	4.4396E-07	-0.0000E-39	-1.4192E-07	1.7836E-01	4.7094E-02	0.0000E-39	-2.7348E-02	0.0000E-39
71	4.1238E-07	-0.0000E-39	-7.7514E-08	1.6171E-01	4.3957E-02	0.0000E-39	-3.0825E-02	0.0000E-39
72	3.8294E-07	-0.0000E-39	-2.5743E-08	1.4403E-01	4.0189E-02	0.0000E-39	-3.2514E-02	0.0000E-39
73	3.5551E-07	-0.0000E-39	1.4798E-08	1.2612E-01	3.6060E-02	0.0000E-39	-3.2792E-02	0.0000E-39
74	3.2997E-07	-0.0000E-39	4.5524E-08	1.0858E-01	3.1783E-02	0.0000E-39	-3.1990E-02	0.0000E-39
75	3.0620E-07	-0.0000E-39	6.7817E-08	9.1862E-02	2.7527E-02	0.0000E-39	-3.0392E-02	0.0000E-39
76	2.8409E-07	-0.0000E-39	8.2987E-08	7.6290E-02	2.3420E-02	0.0000E-39	-2.8237E-02	0.0000E-39
77	2.6354E-07	-0.0000E-39	9.2250E-08	6.2068E-02	1.9555E-02	0.0000E-39	-2.5726E-02	0.0000E-39
78	2.4444E-07	-0.0000E-39	9.6715E-08	4.9310E-02	1.5993E-02	0.0000E-39	-2.3021E-02	-0.0000E-39
79	2.2671E-07	0.0000E-39	9.7373E-08	3.8058E-02	1.2775E-02	-0.0000E-39	-2.0251E-02	-0.0000E-39
80	2.1024E-07	0.0000E-39	9.5096E-08	2.8300E-02	9.9180E-03	-0.0000E-39	-1.7518E-02	-0.0000E-39
81	1.9496E-07	0.0000E-39	9.0640E-08	1.9978E-02	7.4257E-03	-0.0000E-39	-1.4896E-02	-0.0000E-39
82	1.8079E-07	0.0000E-39	8.4648E-08	1.3006E-02	5.2888E-03	-0.0000E-39	-1.2440E-02	-0.0000E-39

83	1.6764E-07	0.0000E-39	7.7656E-08	7.2769E-03	3.4896E-03	-0.0000E-39	-1.0185E-02	-0.0000E-39
84	1.5544E-07	0.0000E-39	7.0106E-08	2.6702E-03	2.0039E-03	-0.0000E-39	-8.1518E-03	-0.0000E-39
85	1.4413E-07	0.0000E-39	6.2350E-08	-9.3936E-04	8.0352E-04	-0.0000E-39	-6.3508E-03	-0.0000E-39
86	1.3363E-07	0.0000E-39	5.4667E-08	-3.6778E-03	-1.4167E-04	-0.0000E-39	-4.7815E-03	-0.0000E-39
87	1.2390E-07	0.0000E-39	4.7263E-08	-5.6679E-03	-8.6270E-04	-0.0000E-39	-3.4369E-03	-0.0000E-39
88	1.1487E-07	0.0000E-39	4.0292E-08	-7.0258E-03	-1.3901E-03	-0.0000E-39	-2.3046E-03	-0.0000E-39
89	1.0648E-07	0.0000E-39	3.3856E-08	-7.8594E-03	-1.7532E-03	-0.0000E-39	-1.3688E-03	-0.0000E-39
90	9.8699E-08	0.0000E-39	2.8018E-08	-8.2669E-03	-1.9794E-03	-0.0000E-39	-6.1152E-04	-0.0000E-39
91	9.1470E-08	0.0000E-39	2.2807E-08	-8.3363E-03	-2.0939E-03	-0.0000E-39	-1.3400E-05	-0.0000E-39
92	8.4753E-08	0.0000E-39	1.8228E-08	-8.1448E-03	-2.1193E-03	-0.0000E-39	4.4503E-04	-0.0000E-39
93	7.8508E-08	0.0000E-39	1.4265E-08	-7.7592E-03	-2.0756E-03	-0.0000E-39	7.8292E-04	-0.0000E-39
94	7.2699E-08	0.0000E-39	1.0889E-08	-7.2365E-03	-1.9802E-03	-0.0000E-39	1.0185E-03	-0.0000E-39
95	6.7290E-08	0.0000E-39	8.0569E-09	-6.6242E-03	-1.8481E-03	-0.0000E-39	1.1689E-03	-0.0000E-39
96	6.2252E-08	0.0000E-39	5.7231E-09	-5.9614E-03	-1.6917E-03	-0.0000E-39	1.2497E-03	-0.0000E-39
97	5.7554E-08	0.0000E-39	3.8360E-09	-5.2794E-03	-1.5213E-03	-0.0000E-39	1.2749E-03	-0.0000E-39
98	5.3169E-08	0.0000E-39	2.3433E-09	-4.6026E-03	-1.3453E-03	-0.0000E-39	1.2568E-03	-0.0000E-39
99	4.9074E-08	0.0000E-39	1.1929E-09	-3.9496E-03	-1.1700E-03	-0.0000E-39	1.2062E-03	-0.0000E-39
100	4.5244E-08	0.0000E-39	3.3503E-10	-3.3339E-03	-1.0005E-03	-0.0000E-39	1.1323E-03	-0.0000E-39
101	4.1658E-08	0.0000E-39	-2.7738E-10	-2.7647E-03	-8.4041E-04	-0.0000E-39	1.0427E-03	-0.0000E-39
102	3.8296E-08	0.0000E-39	-6.8766E-10	-2.2476E-03	-6.9220E-04	-0.0000E-39	9.4367E-04	-0.0000E-39
103	3.5141E-08	0.0000E-39	-9.3512E-10	-1.7854E-03	-5.5745E-04	-0.0000E-39	8.4033E-04	-0.0000E-39
104	3.2174E-08	0.0000E-39	-1.0548E-09	-1.3789E-03	-4.3696E-04	-0.0000E-39	7.3657E-04	-0.0000E-39
105	2.9380E-08	0.0000E-39	-1.0775E-09	-1.0267E-03	-3.3098E-04	-0.0000E-39	6.3535E-04	-0.0000E-39
106	2.6744E-08	0.0000E-39	-1.0297E-09	-7.2672E-04	-2.3929E-04	-0.0000E-39	5.3876E-04	0.0000E-39
107	2.4253E-08	0.0000E-39	-9.3406E-10	-4.7573E-04	-1.6136E-04	0.0000E-39	4.4820E-04	0.0000E-39
108	2.1892E-08	-0.0000E-39	-8.0933E-10	-2.7010E-04	-9.6447E-05	0.0000E-39	3.6442E-04	0.0000E-39
109	1.9651E-08	-0.0000E-39	-6.7087E-10	-1.0599E-04	-4.3693E-05	0.0000E-39	2.8773E-04	0.0000E-39
110	1.7518E-08	-0.0000E-39	-5.3087E-10	2.0468E-05	-2.1896E-06	0.0000E-39	2.1803E-04	0.0000E-39
111	1.5482E-08	-0.0000E-39	-3.9865E-10	1.1294E-04	2.8962E-05	0.0000E-39	1.5490E-04	0.0000E-39
112	1.3533E-08	-0.0000E-39	-2.8095E-10	1.7482E-04	5.0599E-05	0.0000E-39	9.7726E-05	0.0000E-39
113	1.1661E-08	-0.0000E-39	-1.8221E-10	2.0909E-04	6.3470E-05	0.0000E-39	4.5742E-05	0.0000E-39
114	9.8579E-09	-0.0000E-39	-1.0477E-10	2.1832E-04	6.8209E-05	0.0000E-39	-1.9078E-06	0.0000E-39
115	8.1137E-09	-0.0000E-39	-4.9101E-11	2.0461E-04	6.5322E-05	0.0000E-39	-4.6099E-05	0.0000E-39
116	6.4206E-09	-0.0000E-39	-1.3966E-11	1.6959E-04	5.5189E-05	0.0000E-39	-8.7683E-05	-0.0000E-39
117	4.7704E-09	-0.0000E-39	3.4744E-12	1.1448E-04	3.8062E-05	-0.0000E-39	-1.2744E-04	-0.0000E-39
118	3.1553E-09	0.0000E-39	7.5483E-12	4.0123E-05	1.4087E-05	-0.0000E-39	-1.6602E-04	-0.0000E-39
119	1.5676E-09	0.0000E-39	4.0108E-12	-5.2958E-05	-1.6686E-05	-0.0000E-39	-2.0394E-04	-0.0000E-39
120	0.0000E-39	-0.0000E-39	-0.0000E-39	-1.6444E-04	-5.3864E-05	-0.0000E-39	-2.4172E-04	-0.0000E-39

I	N(PHI)	N(THETA)	N(PHI,THETA)	SIG(PHI)	SIG(THETA)	SG(PHI,THETA)
1	-5.1952E 01	-5.1952E 01	-0.0000E-39	-9.2853E 03	-9.2853E 03	0.0000E-39
2	-5.1685E 01	-5.1452E 01	-0.0000E-39	-9.2770E 03	-9.2746E 03	0.0000E-39
3	-5.1074E 01	-5.0324E 01	-0.0000E-39	-9.2535E 03	-9.2540E 03	0.0000E-39
4	-5.0166E 01	-4.8527E 01	-0.0000E-39	-9.1804E 03	-9.2024E 03	0.0000E-39
5	-4.8977E 01	-4.6071E 01	-0.0000E-39	-8.9995E 03	-9.0915E 03	0.0000E-39
6	-4.7570E 01	-4.2999E 01	-0.0000E-39	-8.6136E 03	-8.8747E 03	0.0000E-39
7	-4.6068E 01	-3.9402E 01	-0.0000E-39	-7.8512E 03	-8.4716E 03	0.0000E-39
8	-4.4721E 01	-3.5465E 01	-0.0000E-39	-6.3253E 03	-7.7112E 03	0.0000E-39
9	-4.3495E 01	-3.1377E 01	-0.0000E-39	-3.2527E 03	-6.2523E 03	0.0000E-39
10	-4.2029E 01	-2.7320E 01	-0.0000E-39	-1.0895E 03	-4.9452E 03	0.0000E-39
11	-4.0103E 01	-2.3338E 01	-0.0000E-39	4.2426E 02	-3.8227E 03	0.0000E-39
12	-3.7878E 01	-1.9558E 01	-0.0000E-39	1.4587E 03	-2.8844E 03	0.0000E-39
13	-3.5471E 01	-1.6058E 01	-0.0000E-39	2.1343E 03	-2.1156E 03	0.0000E-39
14	-3.2976E 01	-1.2887E 01	-0.0000E-39	2.5398E 03	-1.4964E 03	0.0000E-39
15	-3.0463E 01	-1.0068E 01	-0.0000E-39	2.7430E 03	-1.0059E 03	0.0000E-39
16	-2.7985E 01	-7.6039E 00	0.0000E-39	2.7963E 03	-6.2429E 02	-0.0000E-39
17	-2.5582E 01	-5.4872E 00	0.0000E-39	2.7409E 03	-3.3334E 02	-0.0000E-39
18	-2.3284E 01	-3.6999E 00	0.0000E-39	2.6089E 03	-1.1687E 02	-0.0000E-39
19	-2.1109E 01	-2.2179E 00	0.0000E-39	2.4257E 03	3.9200E 01	-0.0000E-39
20	-1.9071E 01	-1.0137E 00	0.0000E-39	2.2113E 03	1.4698E 02	-0.0000E-39
21	-1.7178E 01	-5.7787E-02	0.0000E-39	1.9808E 03	2.1673E 02	-0.0000E-39
22	-1.5431E 01	6.7983E-01	0.0000E-39	1.7459E 03	2.5707E 02	-0.0000E-39
23	-1.3830E 01	1.2285E 00	0.0000E-39	1.5151E 03	2.7513E 02	-0.0000E-39
24	-1.2372E 01	1.6162E 00	0.0000E-39	1.2948E 03	2.7676E 02	-0.0000E-39
25	-1.1050E 01	1.8691E 00	0.0000E-39	1.0892E 03	2.6671E 02	-0.0000E-39
26	-9.8580E 00	2.0112E 00	0.0000E-39	9.0085E 02	2.4875E 02	-0.0000E-39
27	-8.7872E 00	2.0639E 00	0.0000E-39	7.3133E 02	2.2587E 02	-0.0000E-39
28	-7.8292E 00	2.0464E 00	0.0000E-39	5.8110E 02	2.0036E 02	-0.0000E-39
29	-6.9751E 00	1.9753E 00	0.0000E-39	4.4997E 02	1.7396E 02	-0.0000E-39
30	-6.2159E 00	1.8650E 00	0.0000E-39	3.3717E 02	1.4792E 02	-0.0000E-39
31	-5.5429E 00	1.7274E 00	-0.0000E-39	2.4161E 02	1.2316E 02	-0.0000E-39
32	-4.9476E 00	1.5727E 00	-0.0000E-39	1.6191E 02	1.0027E 02	-0.0000E-39
33	-4.4221E 00	1.4092E 00	-0.0000E-39	9.6594E 01	7.9592E 01	-0.0000E-39
34	-3.9588E 00	1.2433E 00	-0.0000E-39	4.4086E 01	6.1317E 01	-0.0000E-39
35	-3.5507E 00	1.0802E 00	-0.0000E-39	2.8315E 00	4.5479E 01	-0.0000E-39
36	-3.1915E 00	9.2376E-01	-0.0000E-39	-2.8683E 01	3.2017E 01	-0.0000E-39
37	-2.8752E 00	7.7676E-01	-0.0000E-39	-5.1888E 01	2.0798E 01	-0.0000E-39
38	-2.5966E 00	6.4106E-01	-0.0000E-39	-6.8113E 01	1.1644E 01	-0.0000E-39
39	-2.3511E 00	5.1781E-01	-0.0000E-39	-7.8570E 01	4.3496E 00	-0.0000E-39
40	-2.1343E 00	4.0754E-01	-0.0000E-39	-8.4344E 01	-1.3042E 00	-0.0000E-39
41	-1.9425E 00	3.1028E-01	-0.0000E-39	-8.6396E 01	-5.5362E 00	-0.0000E-39
42	-1.7724E 00	2.2572E-01	-0.0000E-39	-8.5564E 01	-8.5590E 00	0.0000E-39

43	-1.6212E 00	1.5326E-01	-0.0000E-39	-8.2567E 01	-1.0572E 01	0.0000E-39
44	-1.4863E 00	9.2105E-02	-0.0000E-39	-7.8013E 01	-1.1760E 01	0.0000E-39
45	-1.3655E 00	4.1344E-02	-0.0000E-39	-7.2408E 01	-1.2288E 01	0.0000E-39
46	-1.2571E 00	-1.8740E-05	-0.0000E-39	-6.6167E 01	-1.2301E 01	0.0000E-39
47	-1.1593E 00	-3.3001E-02	-0.0000E-39	-5.9624E 01	-1.1925E 01	0.0000E-39
48	-1.0707E 00	-5.8618E-02	-0.0000E-39	-5.3038E 01	-1.1270E 01	0.0000E-39
49	-9.9027E-01	-7.7847E-02	-0.0000E-39	-4.6610E 01	-1.0425E 01	0.0000E-39
50	-9.1692E-01	-9.1618E-02	-0.0000E-39	-4.0486E 01	-9.4634E 00	0.0000E-39
51	-8.4980E-01	-1.0079E-01	-0.0000E-39	-3.4768E 01	-8.4454E 00	0.0000E-39
52	-7.8820E-01	-1.0615E-01	-0.0000E-39	-2.9520E 01	-7.4173E 00	0.0000E-39
53	-7.3149E-01	-1.0841E-01	-0.0000E-39	-2.4780E 01	-6.4145E 00	0.0000E-39
54	-6.7916E-01	-1.0819E-01	-0.0000E-39	-2.0559E 01	-5.4628E 00	0.0000E-39
55	-6.3076E-01	-1.0605E-01	-0.0000E-39	-1.6851E 01	-4.5799E 00	0.0000E-39
56	-5.8591E-01	-1.0246E-01	0.0000E-39	-1.3637E 01	-3.7770E 00	0.0000E-39
57	-5.4430E-01	-9.7826E-02	0.0000E-39	-1.0887E 01	-3.0600E 00	0.0000E-39
58	-5.0564E-01	-9.2480E-02	0.0000E-39	-8.5654E 00	-2.4304E 00	0.0000E-39
59	-4.6969E-01	-8.6704E-02	0.0000E-39	-6.6326E 00	-1.8868E 00	0.0000E-39
60	-4.3625E-01	-8.0723E-02	0.0000E-39	-5.0472E 00	-1.4250E 00	0.0000E-39
61	-4.0511E-01	-7.4717E-02	0.0000E-39	-3.7676E 00	-1.0395E 00	0.0000E-39
62	-3.7613E-01	-6.8822E-02	0.0000E-39	-2.7535E 00	-7.2374E-01	0.0000E-39
63	-3.4915E-01	-6.3142E-02	0.0000E-39	-1.9665E 00	-4.7031E-01	0.0000E-39
64	-3.2404E-01	-5.7751E-02	0.0000E-39	-1.3711E 00	-2.7178E-01	0.0000E-39
65	-3.0067E-01	-5.2698E-02	0.0000E-39	-9.3475E-01	-1.2074E-01	0.0000E-39
66	-2.7893E-01	-4.8010E-02	0.0000E-39	-6.2830E-01	-1.0101E-02	0.0000E-39
67	-2.5871E-01	-4.3701E-02	0.0000E-39	-4.2595E-01	6.6788E-02	-0.0000E-39
68	-2.3992E-01	-3.9772E-02	0.0000E-39	-3.0526E-01	1.1602E-01	-0.0000E-39
69	-2.2247E-01	-3.6211E-02	0.0000E-39	-2.4694E-01	1.4308E-01	-0.0000E-39
70	-2.0627E-01	-3.3004E-02	0.0000E-39	-2.3470E-01	1.5281E-01	-0.0000E-39
71	-1.9123E-01	-3.0128E-02	0.0000E-39	-2.5499E-01	1.4941E-01	-0.0000E-39
72	-1.7728E-01	-2.7558E-02	0.0000E-39	-2.9675E-01	1.3648E-01	-0.0000E-39
73	-1.6435E-01	-2.5269E-02	0.0000E-39	-3.5109E-01	1.1702E-01	-0.0000E-39
74	-1.5236E-01	-2.3234E-02	0.0000E-39	-4.1108E-01	9.3518E-02	-0.0000E-39
75	-1.4126E-01	-2.1426E-02	0.0000E-39	-4.7143E-01	6.7956E-02	-0.0000E-39
76	-1.3098E-01	-1.9819E-02	0.0000E-39	-5.2828E-01	4.1901E-02	-0.0000E-39
77	-1.2146E-01	-1.8390E-02	0.0000E-39	-5.7892E-01	1.6544E-02	-0.0000E-39
78	-1.1265E-01	-1.7117E-02	0.0000E-39	-6.2165E-01	-7.2479E-03	-0.0000E-39
79	-1.0450E-01	-1.5979E-02	-0.0000E-39	-6.5549E-01	-2.8876E-02	-0.0000E-39
80	-9.6960E-02	-1.4958E-02	-0.0000E-39	-6.8013E-01	-4.7967E-02	-0.0000E-39
81	-8.9984E-02	-1.4038E-02	-0.0000E-39	-6.9568E-01	-6.4327E-02	-0.0000E-39
82	-8.3532E-02	-1.3205E-02	-0.0000E-39	-7.0263E-01	-7.7907E-02	-0.0000E-39
83	-7.7564E-02	-1.2446E-02	-0.0000E-39	-7.0167E-01	-8.8768E-02	-0.0000E-39
84	-7.2044E-02	-1.1750E-02	-0.0000E-39	-6.9369E-01	-9.7051E-02	-0.0000E-39
85	-6.693' -02	-1.1110E-02	-0.0000E-39	-6.7962E-(	-1.0296E-01	-0.0000E-39

86	-6.2217E-02	-1.0517E-02	-0.0000E-39	-6.6045E-01	-1.0672E-01	-0.0000E-39
87	-5.7849E-02	-9.9650E-03	-0.0000E-39	-6.3715E-01	-1.0859E-01	-0.0000E-39
88	-5.3809E-02	-9.4491E-03	-0.0000E-39	-6.1065E-01	-1.0884E-01	-0.0000E-39
89	-5.0072E-02	-8.9650E-03	-0.0000E-39	-5.8180E-01	-1.0772E-01	-0.0000E-39
90	-4.6615E-02	-8.5095E-03	-0.0000E-39	-5.5138E-01	-1.0548E-01	-0.0000E-39
91	-4.3417E-02	-8.0798E-03	-0.0000E-39	-5.2008E-01	-1.0235E-01	0.0000E-39
92	-4.0459E-02	-7.6740E-03	-0.0000E-39	-4.8851E-01	-9.8550E-02	0.0000E-39
93	-3.7723E-02	-7.2903E-03	-0.0000E-39	-4.5717E-01	-9.4261E-02	0.0000E-39
94	-3.5192E-02	-6.9275E-03	-0.0000E-39	-4.2648E-01	-8.9651E-02	0.0000E-39
95	-3.2853E-02	-6.5846E-03	-0.0000E-39	-3.9678E-01	-8.4864E-02	0.0000E-39
96	-3.0690E-02	-6.2610E-03	-0.0000E-39	-3.6833E-01	-8.0021E-02	0.0000E-39
97	-2.8691E-02	-5.9559E-03	-0.0000E-39	-3.4133E-01	-7.5220E-02	0.0000E-39
98	-2.6845E-02	-5.6691E-03	-0.0000E-39	-3.1590E-01	-7.0542E-02	0.0000E-39
99	-2.5141E-02	-5.4000E-03	-0.0000E-39	-2.9215E-01	-6.6052E-02	0.0000E-39
100	-2.3568E-02	-5.1485E-03	-0.0000E-39	-2.7010E-01	-6.1795E-02	0.0000E-39
101	-2.2120E-02	-4.9141E-03	-0.0000E-39	-2.4976E-01	-5.7807E-02	0.0000E-39
102	-2.0786E-02	-4.6968E-03	-0.0000E-39	-2.3110E-01	-5.4111E-02	0.0000E-39
103	-1.9559E-02	-4.4961E-03	-0.0000E-39	-2.1408E-01	-5.0720E-02	0.0000E-39
104	-1.8434E-02	-4.3119E-03	-0.0000E-39	-1.9865E-01	-4.7640E-02	0.0000E-39
105	-1.7402E-02	-4.1439E-03	-0.0000E-39	-1.8471E-01	-4.4871E-02	0.0000E-39
106	-1.6459E-02	-3.9919E-03	-0.0000E-39	-1.7219E-01	-4.2409E-02	0.0000E-39
107	-1.5599E-02	-3.8556E-03	-0.0000E-39	-1.6101E-01	-4.0245E-02	0.0000E-39
108	-1.4818E-02	-3.7347E-03	0.0000E-39	-1.5109E-01	-3.8370E-02	0.0000E-39
109	-1.4111E-02	-3.6291E-03	0.0000E-39	-1.4233E-01	-3.6771E-02	0.0000E-39
110	-1.3475E-02	-3.5384E-03	0.0000E-39	-1.3465E-01	-3.5438E-02	0.0000E-39
111	-1.2904E-02	-3.4625E-03	0.0000E-39	-1.2800E-01	-3.4358E-02	0.0000E-39
112	-1.2397E-02	-3.4010E-03	0.0000E-39	-1.2229E-01	-3.3521E-02	0.0000E-39
113	-1.1951E-02	-3.3539E-03	0.0000E-39	-1.1747E-01	-3.2917E-02	0.0000E-39
114	-1.1562E-02	-3.3208E-03	0.0000E-39	-1.1349E-01	-3.2538E-02	-0.0000E-39
115	-1.1229E-02	-3.3017E-03	0.0000E-39	-1.1030E-01	-3.2376E-02	-0.0000E-39
116	-1.0950E-02	-3.2964E-03	0.0000E-39	-1.0786E-01	-3.2427E-02	-0.0000E-39
117	-1.0722E-02	-3.3047E-03	0.0000E-39	-1.0614E-01	-3.2686E-02	-0.0000E-39
118	-1.0545E-02	-3.3266E-03	-0.0000E-39	-1.0513E-01	-3.3151E-02	-0.0000E-39
119	-1.0417E-02	-3.3620E-03	-0.0000E-39	-1.0480E-01	-3.3821E-02	-0.0000E-39
120	-1.0312E-02	-3.4030E-03	0.0000E-39	-1.0490E-01	-3.4612E-02	-0.0000E-39

VELOCITIES AND ACCELERATIONS

VEL(U)	VEL(V)	VEL(W)	ACC(U)	ACC(V)	ACC(W)
7.276E-08	0.000E-39	-4.346E 01	7.276E-04	0.000E-39	-4.346E 05

6.549E-02	0.000E-39	-4.322E 01	6.549E 02	0.000E-39	-4.322E 05
1.299E-01	0.000E-39	-4.249E 01	1.299E 03	0.000E-39	-4.249E 05
1.920E-01	0.000E-39	-4.127E 01	1.920E 03	0.000E-39	-4.127E 05
2.506E-01	0.000E-39	-3.957E 01	2.506E 03	0.000E-39	-3.957E 05
3.042E-01	0.000E-39	-3.739E 01	3.042E 03	0.000E-39	-3.739E 05
3.516E-01	0.000E-39	-3.478E 01	3.516E 03	0.000E-39	-3.478E 05
3.914E-01	0.000E-39	-3.177E 01	3.914E 03	0.000E-39	-3.177E 05
4.217E-01	0.000E-39	-2.847E 01	4.217E 03	0.000E-39	-2.847E 05
4.421E-01	0.000E-39	-2.511E 01	4.421E 03	0.000E-39	-2.511E 05
4.536E-01	0.000E-39	-2.181E 01	4.536E 03	0.000E-39	-2.181E 05
4.572E-01	0.000E-39	-1.868E 01	4.572E 03	0.000E-39	-1.868E 05
4.541E-01	0.000E-39	-1.578E 01	4.541E 03	0.000E-39	-1.578E 05
4.453E-01	0.000E-39	-1.314E 01	4.453E 03	0.000E-39	-1.314E 05
4.320E-01	0.000E-39	-1.078E 01	4.320E 03	0.000E-39	-1.078E 05
4.151E-01	-0.000E-39	-8.689E 00	4.151E 03	0.000E-39	-8.689E 04
3.954E-01	-0.000E-39	-6.873E 00	3.954E 03	0.000E-39	-6.873E 04
3.738E-01	-0.000E-39	-5.314E 00	3.738E 03	0.000E-39	-5.314E 04
3.511E-01	-0.000E-39	-3.993E 00	3.511E 03	0.000E-39	-3.993E 04
3.276E-01	-0.000E-39	-2.890E 00	3.276E 03	0.000E-39	-2.890E 04
3.041E-01	-0.000E-39	-1.982E 00	3.041E 03	0.000E-39	-1.982E 04
2.808E-01	-0.000E-39	-1.247E 00	2.808E 03	0.000E-39	-1.247E 04
2.582E-01	-0.000E-39	-6.635E-01	2.582E 03	0.000E-39	-6.635E 03
2.364E-01	-0.000E-39	-2.101E-01	2.364E 03	0.000E-39	-2.101E 03
2.156E-01	-0.000E-39	1.325E-01	2.156E 03	0.000E-39	1.325E 03
1.961E-01	-0.000E-39	3.822E-01	1.961E 03	0.000E-39	3.822E 03
1.778E-01	-0.000E-39	5.550E-01	1.778E 03	0.000E-39	5.550E 03
1.608E-01	-0.000E-39	6.652E-01	1.608E 03	0.000E-39	6.652E 03
1.451E-01	-0.000E-39	7.256E-01	1.451E 03	0.000E-39	7.256E 03
1.308E-01	-0.000E-39	7.470E-01	1.308E 03	0.000E-39	7.470E 03
1.177E-01	0.000E-39	7.386E-01	1.177E 03	0.000E-39	7.386E 03
1.058E-01	0.000E-39	7.085E-01	1.058E 03	0.000E-39	7.085E 03
9.509E-02	0.000E-39	6.630E-01	9.509E 02	0.000E-39	6.630E 03
8.544E-02	0.000E-39	6.076E-01	8.544E 02	0.000E-39	6.076E 03
7.679E-02	0.000E-39	5.466E-01	7.679E 02	0.000E-39	5.466E 03
6.906E-02	0.000E-39	4.833E-01	6.906E 02	0.000E-39	4.833E 03
6.217E-02	0.000E-39	4.204E-01	6.217E 02	0.000E-39	4.204E 03
5.604E-02	0.000E-39	3.597E-01	5.604E 02	0.000E-39	3.597E 03
5.059E-02	0.000E-39	3.026E-01	5.059E 02	0.000E-39	3.026E 03
4.576E-02	0.000E-39	2.501E-01	4.576E 02	0.000E-39	2.501E 03
4.147E-02	0.000E-39	2.026E-01	4.147E 02	0.000E-39	2.026E 03
3.766E-02	0.000E-39	1.605E-01	3.766E 02	0.000E-39	1.605E 03
3.429E-02	0.000E-39	1.237E-01	3.429E 02	0.000E-39	1.237E 03
.129E-02	0.000E-39	9.203E-02	3.129E 02	0.000E-39	9.20 02

2.862E-02	0.000E-39	6.528E-02	2.862E 02	0.000E-39	6.528E 02
2.624E-02	0.000E-39	4.306E-02	2.624E 02	0.000E-39	4.306E 02
2.411E-02	0.000E-39	2.495E-02	2.411E 02	0.000E-39	2.495E 02
2.220E-02	0.000E-39	1.050E-02	2.220E 02	0.000E-39	1.050E 02
2.048E-02	0.000E-39	-7.276E-04	2.048E 02	0.000E-39	-7.276E 00
1.893E-02	0.000E-39	-9.174E-03	1.893E 02	0.000E-39	-9.174E 01
1.753E-02	0.000E-39	-1.526E-02	1.753E 02	0.000E-39	-1.526E 02
1.625E-02	0.000E-39	-1.936E-02	1.625E 02	0.000E-39	-1.936E 02
1.509E-02	0.000E-39	-2.185E-02	1.509E 02	0.000E-39	-2.185E 02
1.402E-02	0.000E-39	-2.304E-02	1.402E 02	0.000E-39	-2.304E 02
1.304E-02	0.000E-39	-2.321E-02	1.304E 02	0.000E-39	-2.321E 02
1.213E-02	-0.000E-39	-2.260E-02	1.213E 02	0.000E-39	-2.260E 02
1.130E-02	-0.000E-39	-2.142E-02	1.130E 02	0.000E-39	-2.142E 02
1.052E-02	-0.000E-39	-1.985E-02	1.052E 02	0.000E-39	-1.985E 02
9.800E-03	-0.000E-39	-1.803E-02	9.800E 01	0.000E-39	-1.803E 02
9.128E-03	-0.000E-39	-1.608E-02	9.128E 01	0.000E-39	-1.608E 02
8.503E-03	-0.000E-39	-1.409E-02	8.503E 01	0.000E-39	-1.409E 02
7.919E-03	-0.000E-39	-1.214E-02	7.919E 01	0.000E-39	-1.214E 02
7.374E-03	-0.000E-39	-1.027E-02	7.374E 01	0.000E-39	-1.027E 02
6.865E-03	-0.000E-39	-8.526E-03	6.865E 01	0.000E-39	-8.526E 01
6.389E-03	-0.000E-39	-6.931E-03	6.389E 01	0.000E-39	-6.931E 01
5.945E-03	-0.000E-39	-5.499E-03	5.945E 01	0.000E-39	-5.499E 01
5.529E-03	-0.000E-39	-4.235E-03	5.529E 01	0.000E-39	-4.235E 01
5.141E-03	-0.000E-39	-3.139E-03	5.141E 01	0.000E-39	-3.139E 01
4.778E-03	-0.000E-39	-2.203E-03	4.778E 01	0.000E-39	-2.203E 01
4.440E-03	-0.000E-39	-1.419E-03	4.440E 01	0.000E-39	-1.419E 01
4.124E-03	-0.000E-39	-7.751E-04	4.124E 01	0.000E-39	-7.751E 00
3.829E-03	-0.000E-39	-2.574E-04	3.829E 01	0.000E-39	-2.574E 00
3.555E-03	-0.000E-39	1.480E-04	3.555E 01	0.000E-39	1.480E 00
3.300E-03	-0.000E-39	4.552E-04	3.300E 01	0.000E-39	4.552E 00
3.062E-03	-0.000E-39	6.782E-04	3.062E 01	0.000E-39	6.782E 00
2.841E-03	-0.000E-39	8.299E-04	2.841E 01	0.000E-39	8.299E 00
2.635E-03	-0.000E-39	9.225E-04	2.635E 01	0.000E-39	9.225E 00
2.444E-03	-0.000E-39	9.671E-04	2.444E 01	0.000E-39	9.671E 00
2.267E-03	0.000E-39	9.737E-04	2.267E 01	0.000E-39	9.737E 00
2.102E-03	0.000E-39	9.510E-04	2.102E 01	0.000E-39	9.510E 00
1.950E-03	0.000E-39	9.064E-04	1.950E 01	0.000E-39	9.064E 00
1.808E-03	0.000E-39	8.465E-04	1.808E 01	0.000E-39	8.465E 00
1.676E-03	0.000E-39	7.766E-04	1.676E 01	0.000E-39	7.766E 00
1.554E-03	0.000E-39	7.011E-04	1.554E 01	0.000E-39	7.011E 00
1.441E-03	0.000E-39	6.235E-04	1.441E 01	0.000E-39	6.235E 00
1.336E-03	0.000E-39	5.467E-04	1.336E 01	0.000E-39	5.467E 00
1.239E-03	0.000E-39	4.726E-04	1.239E 01	0.000E-39	4.726E 00

1.149E-03	0.000E-39	4.029E-04	1.149E 01	0.000E-39	4.029E 00
1.065E-03	0.000E-39	3.386E-04	1.065E 01	0.000E-39	3.386E 00
9.870E-04	0.000E-39	2.802E-04	9.870E 00	0.000E-39	2.802E 00
9.147E-04	0.000E-39	2.281E-04	9.147E 00	0.000E-39	2.281E 00
8.475E-04	0.000E-39	1.823E-04	8.475E 00	0.000E-39	1.823E 00
7.851E-04	0.000E-39	1.427E-04	7.851E 00	0.000E-39	1.427E 00
7.270E-04	0.000E-39	1.089E-04	7.270E 00	0.000E-39	1.089E 00
6.729E-04	0.000E-39	8.057E-05	6.729E 00	0.000E-39	8.057E-01
6.225E-04	0.000E-39	5.723E-05	6.225E 00	0.000E-39	5.723E-01
5.755E-04	0.000E-39	3.836E-05	5.755E 00	0.000E-39	3.836E-01
5.317E-04	0.000E-39	2.343E-05	5.317E 00	0.000E-39	2.343E-01
4.907E-04	0.000E-39	1.193E-05	4.907E 00	0.000E-39	1.193E-01
4.524E-04	0.000E-39	3.350E-06	4.524E 00	0.000E-39	3.350E-02
4.166E-04	0.000E-39	-2.774E-06	4.166E 00	0.000E-39	-2.774E-02
3.830E-04	0.000E-39	-6.877E-06	3.830E 00	0.000E-39	-6.877E-02
3.514E-04	0.000E-39	-9.351E-06	3.514E 00	0.000E-39	-9.351E-02
3.217E-04	0.000E-39	-1.055E-05	3.217E 00	0.000E-39	-1.055E-01
2.938E-04	0.000E-39	-1.077E-05	2.938E 00	0.000E-39	-1.077E-01
2.674E-04	0.000E-39	-1.030E-05	2.674E 00	0.000E-39	-1.030E-01
2.425E-04	0.000E-39	-9.341E-06	2.425E 00	0.000E-39	-9.341E-02
2.189E-04	-0.000E-39	-8.093E-06	2.189E 00	0.000E-39	-8.093E-02
1.965E-04	-0.000E-39	-6.709E-06	1.965E 00	0.000E-39	-6.709E-02
1.752E-04	-0.000E-39	-5.309E-06	1.752E 00	0.000E-39	-5.309E-02
1.548E-04	-0.000E-39	-3.987E-06	1.548E 00	0.000E-39	-3.987E-02
1.353E-04	-0.000E-39	-2.810E-06	1.353E 00	0.000E-39	-2.810E-02
1.166E-04	-0.000E-39	-1.822E-06	1.166E 00	0.000E-39	-1.822E-02
9.858E-05	-0.000E-39	-1.048E-06	9.858E-01	0.000E-39	-1.048E-02
8.114E-05	-0.000E-39	-4.910E-07	8.114E-01	0.000E-39	-4.910E-03
6.421E-05	-0.000E-39	-1.397E-07	6.421E-01	0.000E-39	-1.397E-03
4.770E-05	-0.000E-39	3.474E-08	4.770E-01	0.000E-39	3.474E-04
3.155E-05	0.000E-39	7.548E-08	3.155E-01	0.000E-39	7.548E-04
1.568E-05	0.000E-39	4.011E-08	1.568E-01	0.000E-39	4.011E-04
0.000E-39	-0.000E-39	-0.000E-39	0.000E-39	0.000E-39	-0.000E-39

TAPE CODES KODER1,KODER2,KOEES1,KODES2= 10 10 1 11

6.1 WARNINGS AND RECOMMENDATIONS

6.1.1 Choice of Time Interval

The proper choice of the appropriate time interval Δt is important for obtaining good results. If Δt is too large; the response will be highly damped and inaccurate. On the other hand, if Δt is too small, the program will take a large amount of time to run. In addition, it appears that having too small a Δt may give rise to numerical instabilities in the pressure calculations. In the sample problem Δt of 0.1 ms was used, which gave good results.

6.1.2 Number of Iterations

There is an unidentifiable bug in the program which makes it necessary that a restart be made after about 140 iterations through the shell program. Should 160 iterations be exceeded, the program will "blow up." Therefore, it is recommended that the job be run in segments of roughly 1 ms. between restarts. The method of restarting is explained in Sections 1.3 and 5.3. In the calculations made for the sample problem, the index IVX was set to about 25, and a restart was made every 1.0 ms. to 7 ms. Thereafter, because of the increase in the number of iterations to convergence in each time cycle, restarts were made at intervals of 0.5 ms.

6.1.3 DECRD

The subroutine DECRD is in the NAA program library and consequently does not appear specifically in the source decks. In installations without this program in their library, the subroutine should be inserted in the zero link behind the subroutine MMY.

7.1

PROGRAM LISTING

```
$IBJOB
$IBFTC 157DR                                                              00000010
C     HYDROELASTIC RESPONSE OF SHELLS OF REVOLUTION                       00000020
C                                                                         00000030
C     REFERENCE  ** AIAA JOURNAL, VOL. 1, NO. 8, AUGUST 1963, PG.1833FF   00000040
C                   AND VOL. 2, NO. 3, MARCH 1964, PG. 590FF              00000050
C                                                                         00000060
C  NOMENCLATURE                                                           00000070
C     EN          NUMBER OF POINTS                                        00000080
C   * AO          REFERENCE LENGTH (IN)                                   00000090
C   * HO          REFERENCE THICKNESS (IN)                                00000100
C   * EO          REFERENCE YOUNGS MODULUS (PSI)                          00000110
C   * SIGO        REFERENCE STRESS (PSI)                                  00000120
C   * ENFO        INITIAL VALUE OF THE FOURIER COMPONENT                  00000130
C   * ENFL        LAST FOURIER COMPONENT                                  00000140
C   * POI         POISSONS RATIO                                          00000150
C   * THETA       HORIZONTAL ANGLE (0,-) THETA VALUES COMPLETED           00000160
C   * PIXI        CRT INDICATOR   PLOTS CURVE WHEN NON-ZERO               00000170
C   * SPRL        LOCATION OF SPRING                                      00000180
C   * UK          SPRING VALUE  -  PHI DIRECTION                          00000190
C   * VK          DITTO  * * *  -  THETA DIRECTION                        00000200
C   * WK          DITTO  * * *  -  N DIRECTION                            00000210
C   * EMK         DITTO  * * *  -  MOMENT                                 00000220
C   * TAU1        LENGTH OF FIRST TIME INTERVAL                           00000230
C   * ENT1        NO. OF INCREMENTS IN FIRST TIME INTERVAL                00000240
C   * PI1         PRINT INTERVAL. WILL ALWAYS PRINT LAST INTERVAL VALUES  00000250
C   * TAU2,ENT2,PI2     ** DITTO ** FOR THE 2ND TIME INTERVAL             00000260
C   * TAU3,ENT3,PI3     ** DITTO ** FOR THE 3RD TIME INTERVAL             00000270
C   * MASS        MASS DENSITY OF THE MATERIAL                            00000280
C   * CFE,CZ      COEFFICIENTS OF VISCOUS DAMPING AT EA. STATION          00000290
C   * SKFE,SKZ        SPRING CONSTANTS OF SHELL UNDER ELAST. RESTRAINT    00000300
C   * SUM         FOURIER SUMMING INCREMENT                               00000310
C     EN1         1. = OPEN SHELL    2. = CLOSED      SET IN GEOM         00000320
C     DEL         FINITE DIFFERENCE INTERVAL                              00000330
C   * TFI         TIME FUNCTION IND. (-)=CALL ACCN  (+)=TIME FUNCTIONS    00000340
C   * VIN         INITIAL IMPACT VELOCITY                                 00000350
C     RESTRT      NON-ZERO, THIS IS A RESTART                             00000360
C     PNCH        NON-ZERO, PUNCH CARDS FOR POSSIBLE RESTART              00000370
C                                                                         00000380
C     R(I)        DISTANCE FROM AXIS (IN)  COMPUTED BY SUBR. GEOM         00000390
C     WTHD(I)     NON-DIMENSIONAL CURVATURE - THETA DIRECTION             00000400
C     WFE(I)      DITTO  * * *  -  PHI DIRECTION                          00000410
C     GAMA(I)     RHO' /RHOX                                              00000420
```

```
C     RHOX(I)     R /A0                                                          00000430
C     D(I)        MEMBRANE STIFFNESS (DIMENSIONLESS)                             00000440
C     EK(I)       BENDING STIFFNESS (DIM)                                        00000450
C     E1(I)       MODULUS OF ELASTICITY                                          00000460
C     ALF(I)      THERMAL EXPANSION COEFFICIENT        * * DITTO * *             00000470
C     DNA(I)      DISTANCE FROM NEUTRAL AXIS                                     00000480
C     T(I)        TEMPERATURE CHANGE                                             00000490
C     ENT(I)      TEMPERATURE LOAD (DIM)                                         00000500
C     EMT(I)      TEMPERATURE LOAD (DIM)                                         00000510
C     PFE(I)      FOURIER COMPONENT FOR LOAD  -  PHI DIRECTION                   00000520
C     PTH(I)      DITTO    * * *              -  THETA DIRECTION                 00000530
C     PN(I)       DITTO    * * *              -  N DIRECTION                     00000540
C     DZ0,VZ0,AZ0 COEF. OF INITIAL VALUES OF DISPLACEMENT, VELOCITY, LD.         00000550
C     DF0,VF0,AF0       ** DITTO **                                              00000560
C  *  EM1(4,4)    DIAGONAL BOUNDARY FORCE MATRIX  (OMEGA)                        00000570
C  *  EM3(4,4)    DIAGONAL BOUNDARY DISPLACEMENT MATRIX  (LAMBDA)                00000580
C  *  EM5(4)      COLUMN BOUNDARY MATRIX  (L)                                    00000590
C  *  EM1N(4,4)   DIAGONAL BOUNDARY FORCE MATRIX AT BOTTOM                       00000600
C  *  EM3N(4,4)   DIAGONAL BOUNDARY DISPLACEMENT MATRIX AT BOTTOM                00000610
C  *  EM5N(4)     COLUMN BOUNDARY MATRIX AT BOTTOM                               00000620
C     MO(I)       MASS PER UNIT AREA OF SHELL =  2.*DNA(I) * MASS                00000630
C     TDEL        TIME INCREMENT, CURRENT.  E.G. TAU1 /ENT1                      00000640
C     NJT         NUMBER OF TIME INCREMENTS DESIRED, CURRENT .                   00000650
C     TIME        RUNNING TIME COUNT                                             00000660
C     PRNT        CURRENT PRINT INTERVAL                                         00000670
C                                                                                00000680
C  * PARAMETERS PRECEDED BY * ARE READ IN EXECUTIVE PROGRAM, OTHERS               00000690
C       ARE SET IN GEOM OR CRVFIT.                                               00000700
C                                                                                00000710
C                                                                                00000720
      DIMENSION   BCD(36), PN(200)                                               00000730
C                                                                                00000740
      REAL        MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,          00000750
     1            MO                                                             00000760
      EQUIVALENCE      (DA(1), EN   ),(DA(2),  AU   ),(DA(3),  HO   ),00000770
     1(DA(4),  FO   ),(DA(5),  SIGO),(DA(6),  ENFO ),(DA(7),  FNFL ),00000780
     2(DA(8),  POI  ),(DA(9),  THETA),(DA(10), PIXI ),(DA(11), SPRL ),00000790
     3(DA(12), UK   ),(DA(13), VK  ),(DA(14),  WK  ),(DA(15),  EMK  ),00000800
     4(DA(16), TAU1 ),(DA(17), ENT1),(DA(18),  PI1 ),(DA(19),  TAU2 ),00000810
     5(DA(20), ENT2 ),(DA(21), PI2 ),(DA(22),  TAU3),(DA(23),  FNT3 ),00000820
     6(DA(24), PI3  ),(DA(25), MASS),(DA(26),  CFE ),(DA(27),  CZ   ),00000830
     7(DA(28), SKFE ),(DA(29), SKZ ),(DA(30),  SUM ),(DA(31),  EN1  ),00000840
     8(DA(32), DEL  ),(DA(33), TFI ),(DA(34),  VIN ),(DA(35),  IND  ),00000850
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```
     9(DA(36), RESTRT),(DA(37), PNCH ),(DA(39),  DRW  )                    00000860
      EQUIVALENCE      (DA(40),  R   ),(DA(240), WTHD ),(DA(440), WFE ),00000870
     1(DA(640), GAMA ),(DA(840), RHOX),(DA(1040),  D  ),(DA(1240), EK ),00000880
     2(DA(1440),  EI ),(DA(1640), ALF),(DA(1840), DNA ),(DA(2040),  T ),00000890
     3(DA(2240), ENT ),(DA(2440), EMT),(DA(2640),  PN ),(DA(2840), PFE),00000900
     4(DA(3040), PTH ),(DA(3240), DZO),(DA(3440), VZO ),(DA(3640), AZO),00000910
     5(DA(3840), DFO ),(DA(4040), VFO),(DA(4240), AFO ),(DA(4440), EM1),00000920
     6(DA(4456), EM3 ),(DA(4472), EM5),(DA(4476), EM1N),(DA(4492),EM3N),00000930
     7(DA(4508), EM5N)                                                     00000940
C                                                                          00000950
      COMMON   DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, ELAM2,        00000960
     1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),      00000970
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,        00000980
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                             00000990
     4  S77, S78, BTA11, BTA33, MO(200), OMG2(200), ZP(3,200),             00001000
     5  Z2P(3,200), Z3P(3,200), TIMX, TDEL, PRNT, ENF, PRI, JT, NJT, V1    00001010
     6  ,XX(2800),INDER,ICYL,                                              00001020
     1  JELLO ,IVX, CONV, NO, IV, NOT, PE2( 75), PS( 75), PM1( 75),        00001030
     2 P(4, 75), PP(4, 75), FUN(4), RH, RHO, WT, GAM, GMU( 75),  BP,AP,    00001040
     3  VEL,ACC,R1,ZAP,PIE,RADIUS,NSTART,NSAVE                             00001050
     4  ,KODES1,KODES2,KODER1,KODER2                                       00001060
C                                                                          00001070
C                                        ZERO DATA AND SELECTED MATRICES   00001080
 4007  REWIND  9                                                           00001090
      READ(5,4000)NSTART,NSAVE,NINT,KODER2,KODES2                          00001100
 4000  FORMAT(5I12)                                                        00001110
C     NSTART=0, REGULAR RUN FROM ZERO TIME                                 00001120
C     NSTART=1, RESTART, READ IN COMMON FROM TAPE                          00001130
C     NAAVE=0, REGULAR EXIT                                                00001140
C     NSAVE=1, SAVE COMMON ON TAPE FRR FUTURE RESTART                      00001150
      IF(NSTART.EQ.0) GO TO 6000                                           00001160
      REWIND 13                                                            00001170
C     OUTPUT FROM PREVIOUS RUN ON LOGIGAL UNIT 13 IS PUT ON UNIT 3         00001180
      REWIND 12                                                            00001190
 4010 FORMAT(I12)                                                          00001200
      READ(13) KODER1                                                      00001210
      IF(KODER1.NE.KODER2) GO TO 5512                                      00001230
      KODER2=KODER2+10                                                     00001240
      WRITE( 9) KODER2                                                     00001250
      DO 4011 I=1,NINT                                                     00001260
      READ(13) JT,TIMX,AP,VEL,ACC,BP,N,NOT                                 00001270
      WRITE(9) JT,TIMX,AP,VEL,ACC,BP,N,NOT                                 00001280
      DO 4012 J=1,3                                                        00001290
```

```
      READ (13) (DA(K),K=1,NOT)                                                 00001300
 4012 WRITE( 9) (DA(K),K=1,NOT)                                                 00001310
      DO 4013 J=1,14                                                            00001320
      READ (13)  (DA(K),K=1,N)                                                  00001330
 4013 WRITE( 9)  (DA(K),K=1,N)                                                  00001340
 4011 CONTINUE                                                                  00001350
      REWIND 13                                                                 00001360
      GO TO 1                                                                   00001370
 5    IF(NSAVE.EQ.0) GO TO 4007                                                 00001380
C     RESTART-- SAVE TIMX,ZPREV,OMEG                                            00001390
      REWIND 8                                                                  00001400
      KODES2=KODES2+10                                                          00001410
      WRITE( 8) KODES2                                                          00001420
      WRITE(8)    (OMG2(I),I=1,2002),                                           00001430
     1           INDER,ICYL,JELLO,IVX,CONV,NO,IV,NOT,(PE2(I),I=1,918),         00001440
     3      (DA(I),I=2640,2839),                                               00001450
     2      (DA(I),I=3240,3439),(DA(I),I=3840,4039)                            00001460
      REWIND 8                                                                  00001470
      WRITE(6,6002) KODER1,KODER2,KODES1,KODES2                                 00001480
 6002  FORMAT(1H0,40HTAPE CODES  KODER1,KODER2,KOEES1,KODES2=,4I12)             00001490
      GO TO 4007                                                                00001500
 6000  CONTINUE                                                                 00001510
      KODER1=10                                                                 00001520
      KODER2=10                                                                 00001530
      KODES2=1                                                                  00001540
      KODES1=1                                                                  00001550
      WRITE( 9) KODER1                                                          00001560
    1 DO   2     I = 1,4511                                                     00001570
    2 DA(I)  =  0.                                                            00001580
      DO   4     K = 1,3                                                        00001590
      DO   4     L = 1,200                                                      00001600
      ZP(K,L)  =  0.                                                            00001610
      Z2P(K,L)  =  0.                                                           00001620
    4 Z3P(K,L)  =  0.                                                           00001630
C                                    READ AND PRINT TITLE CARDS                 00001640
      READ(5,6) BCD                                                             00001650
    6 FORMAT( 12A6 )                                                            00001660
      WRITE          (6, 7) BCD                                                 00001670
    7 FORMAT(1H1 /(18X, 12A6 //) )                                              00001680
      SL2  =  1.                                                                00001690
   10 TIMX  =  0.                                                               00001700
      JT  =  1                                                                  00001710
      READ(5,3004) RHO,WT                                                       00001720
 3004  FORMAT(2E12.8)                                                          00001735
```

```
C       RHO= FLUID DENSITY -- LBS/CU FT                                  00001730
C       WT = BODY WEIGHT --  LBS                                         00001740
C       VIN = INITIAL IMPACT VELOCITY -- INCHES PER SECOND               00001750
        READ(5,3000)INDER,CONV,IVX,ICYL                                  00001760
 3000 FORMAT(I12,E12.8,2I12)                                             00001770
C       IF INDER = 0, NO ITERATION                                       00001780
C       CONV=PRESSURE CONVERGENCE CRITERION                              00001790
C       VX=MAX NO OF ITERATIONS CYCLES                                   00001800
C       IF ICYL = 0, IMPACT OF A SPHERE                                  00001810
C       IF ICYL = 1 , IMPACT OF A CYLINDER                               00001820
C       FOR A STSTIC CASE, TAU1=.1 MS, ENT1=1, P1=1, MASS=0.0            00001830
C                                                                        00001840
   12 CALL  DECRD( DA )                                                  00001850
C                                                                        00001860
        TDEL  =  TAU1 /ENT1                                              00001870
        IF(NSTART.EQ.1) GO TO 5002                                       00001880
        RHO=RHO/1728.0                                                   00001890
         RH = RHO / (32.2*12.)                                           00001900
        P(1,1)=  1.                                                      00001910
        P(2,1)=  1.                                                      00001920
        P(3,1)=  1.                                                      00001930
        P(4,1)=  1.                                                      00001940
        PP(1,1) =  1.                                                    00001950
        PP(2,1)=  6.                                                     00001960
        PP(3,1)=    15.                                                  00001970
        PP(4,1)=    28.                                                  00001980
        GMU(1) = 1.                                                      00001990
        PIE = 3.14159265                                                 00002000
        FUN(1)= -2./ PIE *3.                                             00002010
        FUN(2)= -7./(2.*PIE)*( 2.**3/6.)** 2                             00002020
        FUN(3)= -11./(2.*PIE)*(4.*2.**5/ 120. )**2                       00002030
        FUN(4)= -15./(2.*PIE)*(36.*2.**7 /(7.*6.*120.) )** 2             00002040
        JELLO=0                                                          00002050
 5002 CONTINUE                                                           00002060
        PRNT  =  PI1                                                     00002070
        ENF   =  ENF0                                                    00002080
        NJT   =  ENT1                                                    00002090
        PRI   =  PI1                                                     00002100
        NTH   =  0                                                       00002110
        ELAM  =  H0 /A0                                                  00002120
        ELAM2  =  ELAM **2                                               00002130
        S1  =  1. - POI                                                  00002140
        S2  =  1. + POI                                                  00002150
```

```
      S77  =  A0/E0 * A0/H0                                          00002160
C                                                                    00002170
C                                                  GEOMETRY          00002180
   20 CALL GEOM                                                      00002190
      IF(NSTART.EQ.1) GO TO 25                                       00002200
      RADIUS=1./WFE                                                  00002210
      GAM=8.*2.**.5*RHO*RADIUS**1.5/(3.*WT)                          00002220
C                                                                    00002230
   25 S78  =  2. * DEL /TDEL                                         00002240
      TIMX  =  TIMX + TDEL                                           00002250
      IF(INDER)3002,3002,3001                                        00002260
 3002 IND=1                                                          00002270
      GO TO 3003                                                     00002280
 3001 CONTINUE                                                       00002290
      IV=1                                                           00002300
      IND=-1                                                         00002310
 3003 CONTINUE                                                       00002320
      IF(TFI .GE. 0.)  GO TO 30                                      00002330
      IF(TIMX .NE. TDEL)  GO TO 32                                   00002340
C                                          COLUMN DATA SET-UP        00002350
   30 CALL  CRVFIT                                                   00002360
C                                          NORMAL PRESSURES          00002370
      IF(TFI .GE. 0.)  GO TO 40                                      00002380
   32 CALL  ACCN                                                     00002390
C                                                  DEFLECTIONS       00002400
   40 CALL  DEFLTN                                                   00002410
C                                                  WHERE NEXT        00002420
   50 CALL  PATH                                                     00002430
      SL1=0.0                                                        00002440
      IF(IND)51,52,55                                                00002450
   51 IND=0                                                          00002460
      GO TO 54                                                       00002470
   52 IV=IV+1                                                        00002480
      IF(IV.EQ.2.AND.JT.EQ.1) GO TO 54                               00002490
      NOP=NOT-1                                                      00002500
      DO 102 I=1,NOP                                                 00002510
      IF(ABS(1.0-PE2(I)/PS(I)).GT.CONV) GO TO 54                     00002520
  102 CONTINUE                                                       00002530
      GO TO 55                                                       00002540
   54 IF(IV.GT.IVX) GO TO 57                                         00002550
      NOP=NOT-1                                                      00002560
      DO 103 I=1,NOP                                                 00002570
  103 PS(I)=PE2(I)                                                   00002580
```

```
      GO TO 32                                                          00002590
   57 WRITE(6,58)IVX                                                    00002600
   58 FORMAT(1H0,39HNO OF ITERATIONS HAS EXCEED LIMIT IVX=,I3)          00002610
   55 CONTINUE                                                          00002620
      DO 59     I = 1,N                                                00002630
      DO 59     J = 1,3                                                00002640
      Z3P(J,I)  =  Z2P(J,I)                                            00002650
      Z2P(J,I)  =  ZP(J,I)                                             00002660
   59 ZP(J,I)   =  Z(J,I)                                              00002670
      DO 5050 I=1,NOT                                                  00002680
      IF(PN(I).LE.0.0) GO TO 101                                       00002690
 5050 PN(I)=0.0                                                        00002700
  101 CONTINUE                                                         00002710
      NOD=NO+2                                                         00002720
      NODD=NO+3                                                        00002730
      WRITE(6,33)TIMX,AP,VEL,ACC,BP,(I,PN(I),PM1(I),PE2(I),I=1,NOD)    00002740
   33 FORMAT(1H1,///37X,27HWATER IMPACT PRESSURE LOADS ///,             00002750
     11H0,34H                          TIME  =  ,E17.8,3HSEC,/        00002760
     21H0,34H  MAX RAD OF PRESSURE PROFILE  =  ,E17.8,3HINS,/         00002770
     61H0,34H                VEHICLE VELOCITY  =  ,E17.8,7HINS/SEC,/  00002780
     41H0,34H          VEHICLE ACCELERATION  =  ,E17.8,1HG,/          00002790
     51H0,34H          DEPTH OF PENETRATION  =  ,E17.8,3HINS,//       00002800
     61H0,5X,7HSTATION,10X,14HTOTAL PRESSURE,10X,20HRIGID-BODY COMPONENT00002810
     7  10X,17HELASTIC COMPONENT,//(I9,15X,F12.4,18X,F12.4,15X,E12.4)) 00002820
      WRITE(6,34)(I,PN(I),I=NODD,N)                                    00002830
   34 FORMAT(I9,15X,F12.4)                                             00002840
      WRITE(9)JT,TIMX,AP,VEL,ACC,BP,N,NOT                              00002850
      WRITE(9)(PN(I),I=1,NOT)                                          00002860
      WRITE(9)(PM1(I),I=1,NOT)                                         00002870
      WRITE(9)(PE2(I),I=1,NOT)                                         00002880
      JT=JT+1                                                          00002890
      IF( SL1 )  5,60,25                                               00002900
C                                          INTERNAL LOADS              00002910
   60 CALL  INTLDS                                                     00002920
C                                          FOURIER SUMMING             00002930
   70 CALL  SUMS                                                       00002940
      IF( SL1 )  5,25,72                                               00002950
C                                                                      00002960
   72 IF(ENFL - ENF .GT. 1.E-2)  GO TO 10                              00002970
      IF(PIXI .EQ. 0.)  GO TO 90                                       00002980
C                                          CRT OUTPUT                  00002990
   80 CALL  PIX                                                        00003000
   90 GO  TO  5                                                        00003010
```

```
 5512  WRITE(6,5513) KODER1,KODER2                                    00003020
 5513  FORMAT(1HO,58HINPUT RESPONSE TAPES WRONG-CHECK TAPE NOS.--KODER1,00003030
     1KODER2=,2I12)                                                   00003040
       STOP                                                           00003050
       END                                                            00003060
```

```
$IBFTC MMPY                                                          00003070
C       MATRIX MULTIPLY SUBROUTINE                  DECK NO. 8K-901  00003080
C                                                                    00003090
C  ARGUMENTS                                                         00003100
C       L  NO. OF ROWS X MATRIX                                      00003120
C       M  NO. OF COLS X MATRIX                                      00003130
C       N  NO. OF COLS Y MATRIX                                      00003140
C       X(I,K)    MRA                                                00003150
C       Y(K,J)    MMY                                                00003160
C       Z(I,J)    MSR                                                00003170
        SUBROUTINE MMY(L,M,N,X,Y,Z)                                  00003180
        DIMENSION   X(4,4), Y(4,4), Z(4,4)                           00003190
        DO 30 I=1,L                                                  00003200
        DO 30 J=1,N                                                  00003210
        Z(I,J)=0.0                                                   00003220
        DO 30 K=1,M                                                  00003230
   30   Z(I,J)=Z(I,J)+X(I,K)*Y(K,J)                                  00003240
        RETURN                                                       00003250
        END                                                          00003260
```

```
$IBFTC MADD                                                          00003270
C       MATRIX ADD SUBROUTINE                    DECK NO. 8K-903     00003280
C                                                                    00003290
C  ARGUMENTS                                                         00003300
C       L  NO. OF ROWS                                               00003310
C       M  NO. OF COLS                                               00003320
C       A(I,J)      MRA                                              00003330
C       B(I,J)      MAD                                              00003340
C       C(I,J)      MSR                                              00003350
        SUBROUTINE MAD(L,M,A,B,C)                                    0000336
        DIMENSION   A(4,4), B(4,4), C(4,4)                           00003370
        DO 30 I=1,L                                                  00003380
        DO 30 J=1,M                                                  00003390
   30   C(I,J)=A(I,J)+B(I,J)                                         000034 )0
        RETURN                                                       00003410
        END                                                          00003420
```

```
      $ORIGIN        CHAIN                                                    00003430
      $IBFTC GMTRY                                                           00003440
      C       GEOMETRY COMPUTATION SUBROUTINE              6J-157DR *LINK JA 00003450
      C                                                                      00003460
            SUBROUTINE GEOM                                                  00003470
      C                                                                      00003480
      C  NOMENCLATURE                                                        00003490
      C        GMI    -  GEOMETRY INDICATOR                                  00003500
      C               =  1.0  - CONE - CYLINDER                **            00003510
      C               =  2.0  - SPHERE - TOROID                **           00003520
      C               =  3.0  - GENERAL DISCRETE POINTS        **           00003530
      C               =  4.0  - ARBITRARY FUNCTIONS            **           00003540
      C                                                                      00003550
      C     EN          NO. OF POINTS /REGION                              00003560
      C     PFLAG       PRINT INDICATOR, NON-ZERO PRINTS ALL INPUT DATA    00003570
      C                 **                                       **        00003580
      C                      GMI = 1.0                                       00003590
      C                   RA1   =   RADIUS AT STATION 1                      00003600
      C                   AXL   =   AXIAL SURFACE LENGTH                     00003610
      C                   ANX   =   ANGLE - GENERATOR AND AXIS OF REVOLUTION 00003620
      C                 **                                       **        00003630
      C                      GMI = 2.0                                       00003640
      C                   RC    =   RADIUS OF CURVATURE                      00003650
      C                   ROFF  =   OFFSET DISTANCE TO CENTER OF CURVATURE   00003660
      C                   PHI0  =   INITIAL OPENING ANGLE FROM VERTICAL AXIS 00003670
      C                   PHIN  =   FINAL OPENING ANGLE FROM VERTICAL AXIS   00003680
      C                 **                                       **        00003690
      C                      GMI = 3.0  (-3.0 DISCRETE ARCLENGTHS)           00003700
      C                   EM    =   NO. OF RIPT'S GIVEN                      00003710
      C                   RIPT  =   DISCRETE RADII                           00003720
      C                   XIPT = DISCRETE XI'S  (OR ARCLENGTHS)              00003730
      C                 **                                       **        00003740
      C                                                                      00003750
            DIMENSION RIPT(200),  XIPT(200),  R(200),  XSI(200),  WTH(200),  00003760
           1 WFE(200),  RHOX(200),  GAMA(200),  SARB(200),  SURF(200),       00003770
           2 GDA(408), RHOP(200)                                             00003780
            DIMENSION XJ(400), RJ(400), DLR(400)                             00003790
      C                                                                      00003800
            EQUIVALENCE  (GDA( 1),      GMI),     (GDA( 2),      EN),      00003810
           1             (GDA( 3),    PFLAG),     (GDA( 4),    RA1,RC),    00003820
           2             (GDA( 5),  AXL, ROFF),   (GDA( 6),  ANX, PHI0),    00003830
           3             (GDA( 7),     PHIN),     (GDA( 8),      EM),      00003840
           4             (GDA( 9),     RIPT),     (GDA(209),    XIPT)      00003850
```

```
C                                                                       00003860
C                                                                       00003870
      REAL      MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,   00003880
     1          MO                                                      00003890
      EQUIVALENCE      (DA(1), ENS  ),(DA(2),  AO   ),(DA(3),  HO   ),00003900
     1(DA(4),  EO   ),(DA(5),  SIGO ),(DA(6),  ENFO ),(DA(7),  ENFL ),00003910
     2(DA(8),  POI  ),(DA(9),  THETA),(DA(10), PIXI ),(DA(11), SPRL ),00003920
     3(DA(12),  UK  ),(DA(13),  VK  ),(DA(14),  WK  ),(DA(15),  EMK ),00003930
     4(DA(16),  TAU1),(DA(17),  ENT1),(DA(18),  PI1 ),(DA(19),  TAU2),00003940
     5(DA(20),  ENT2),(DA(21),  PI2 ),(DA(22),  TAU3),(DA(23),  ENT3),00003950
     6(DA(24),  PI3 ),(DA(25),  MASS),(DA(26),  CFE ),(DA(27),  CZ  ),00003960
     7(DA(28),  SKFE),(DA(29),  SKZ ),(DA(30),  SUM ),(DA(31),  EN1 ),00003970
     8(DA(32),  DEL )                                                   00003980
      EQUIVALENCE      (DA(40),  R   ),(DA(240), WTH ),(DA(440), WFE ),00003990
     1(DA(640), GAMA),(DA(840), RHOX),(DA(1040), D  ),(DA(1240), EK  ),00004000
     2(DA(1440),  E1 ),(DA(1640), ALF),(DA(1840), DNA),(DA(2040),  T  ),00004010
     3(DA(2240), ENT ),(DA(2440), EMT),(DA(2640),  PN ),(DA(2840), PFE),00004020
     4(DA(3040), PTH ),(DA(3240), DZO),(DA(3440), VZO ),(DA(3640), AZO),00004030
     5(DA(3840), DFO ),(DA(4040), VFO),(DA(4240), AFO ),(DA(4440), EM1),00004050
     6(DA(4456), EM3 ),(DA(4472), EM5),(DA(4476), EM1N),(DA(4492),EM3N),00004060
     7(DA(4508), EM5N)                                                  00004070
C                                                                       00004080
      COMMON   DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, ELAM2,     00004090
     1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),   00004100
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,     00004110
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                          00004120
     4  S77, S78, BTA11, BTA33, M0(200), OMG2(200), ZP(3,200),          00004130
     5  Z2P(3,200), Z3P(3,200), TIME, TDEL, PRNT, ENF, PRI              00004140
     6  ,JT,NJT,V1                                                      00004150
     7  ,XX(2801),ICYL                                                  00004160
C                                                                       00004170
      IF(SL2 .EQ. 0.) GO TO 1005                                        00004180
      DO   1     I = 1,408                                              00004190
    1 GDA(I)  =  0.                                                     00004200
      CALL DECRD(GDA)                                                   00004210
      N = EN                                                            00004220
      NN = N - 1                                                        00004230
      ENS  =  EN                                                        00004240
C                                                                       00004250
      IF (GMI - 2.0) 20, 35, 50                                         00004260
C                                                                       00004270
C                  CONE - CYLINDER                    **                00004280
C                                                                       00004290
```

```
   20 IF (PFLAG .NE. 0.0) WRITE(6,22)          N, RA1, AXL, ANX          00004300
   22 FORMAT(1H1,31X,34HGEOMETRY DATA FOR CONE OR CYLINDER// 35X,22HNUMB00004310
     1ER OF STATIONS =  ,I4//6X,7HRA1   =,1PE13.4,7X,7HAXL   =,E13.4,7X,00004320
     2 7HANX   =,E13.4)                                                  00004330
C                                                                        00004340
      DFL =  AXL/(EN - 1.0)                                              00004350
      SINFI  = SIND(ANX)                                                 00004360
      COSFI  = COSD(ANX)                                                 00004370
      WTH(1) = A0 * COSFI/RA1                                            00004380
      WFE(1) = 0.0                                                       00004390
      RHOX(1) = RA1/A0                                                   00004400
      R(1) = RA1                                                         00004410
C                                                                        00004420
      DO 30 I = 2,N                                                      00004430
      R(I)  = R(I-1) + DEL * SINFI                                       00004440
      WTH(I) = A0 * COSFI /R(I)                                          00004450
      WFE(I) = 0.0                                                       00004460
   30 RHOX(I) = R(I)/A0                                                  00004470
      GO TO 95                                                           00004480
C                                                                        00004490
C                  SPHERE - TOROID                    **                00004500
C                                                                        00004510
   35 IF (PFLAG .NE. 0.0) WRITE (6,37) IRGN, N, RC, ROFF, PHIO, PHIN     00004520
   37 FORMAT(1H1,31X,24HGEOMETRY DATA FOR REGION, I3,18H (SPHERE - TOROI00004530
     XD) //                                                 35X,22HNUMB00004540
     1ER OF STATIONS =  ,I4//6X,7HRC    =,1PE13.4,7X,7HROFF   =,E13.4,7X,00004550
     2 7HPHIO  =,F13.4,7X,7HPHIN  =,F13.4 )                              00004560
      ANGSP = PHIN - PHIO                                                00004570
C                                                                        00004580
      DFL =  ANGSP/(FN - 1.0)                                            00004590
      BPHI = PHIO                                                        00004600
      BSINP = SIND(PHIO)                                                 00004610
      BCOSP = COSD(PHIO)                                                 00004620
      R(1) = RC * BSINP + ROFF                                           00004630
C                                                                        00004640
      DO 40 I = 1,NN                                                     00004650
      APHI = BPHI + DFL                                                  00004660
      ASINP = SIND(APHI)                                                 00004670
      ACOSP = COSD(APHI)                                                 00004680
      R(I+1) = R(I) + RC * (ASINP - BSINP)                               00004690
      WFE(I) = A0/RC                                                     00004700
      IF(ROFF .EQ. 0.0) GO TO 38                                         00004710
      WTH(I) = A0 * BSINP / R(I)                                         00004720
```

```
      GO TO 39                                                          00004730
   38 WTH(I)  =  WFE(I)                                                 00004740
   39 RHOX(I) = R(I)/A0                                                 00004750
      BPHI = APHI                                                       00004760
      BSINP = ASINP                                                     00004770
      BCOSP = ACOSP                                                     00004780
   40 CONTINUE                                                          00004790
      DEL = ABS(DFL)                                                    00004800
      WFE(N) = A0/RC                                                    00004810
      IF(ROFF .EQ. 0.0) GO TO 45                                        00004820
      WTH(N) =  A0 * BSINP / R(N)                                       00004830
      GO TO 46                                                          00004840
   45 WTH(N)  =  WFE(N)                                                 00004850
   46 RHOX(N) = R(N)/A0                                                 00004860
      DEL = DFL * RC * 0.01745329                                       00004870
      IF(ICYL.EQ.0) GO TO 95                                            00004880
      DO 47 I=1,N                                                       00004890
   47 WTH(I)=0.0                                                        00004900
      GO TO 95                                                          00004910
C                                                                       00004920
   50 IF(GMI - 4.0) 75, 51, 51                                          00004930
C                                                                       00004940
   51 WRITE (6,55)                                                      00004950
   55 FORMAT (/// 5X, 44HARBITRARY FUNCTIONS AND CONICS NOT AVAILABLE ) 00004960
C                                                                       00004970
      CALL  EXIT                                                        00004980
      STOP                                                              00004990
C                                                                       00005000
C                    GENERAL DISCRETE POINTS              **           00005010
   75 M  =  EM                                                          00005020
      MM = M - 1                                                        00005030
      MM2 = M- 2                                                        00005040
C                                                                       00005050
      IF (PFLAG .NE. 0.0) WRITE(6,76)IRGN,N, (RIPT(I), XIPT(I), I = 1,M)00005060
   76 FORMAT(1H1,31X,24HGEOMETRY DATA FOR REGION, I3,18H (DISCRETE POINT00005070
     1S) //35X,20HNUMBER OF STATIONS - ,I4//16X,1HR,16X,2HXI //          00005080
     2  (3X,1P2E20.7) )                                                00005090
C                                                                       00005100
      SARB(1) = 0.0                                                     00005110
      IF (GMI) 81, 77, 77                                               00005120
   77 DLXI = XIPT(M) - XIPT(1)                                          00005130
      DO 80 IL = 1,MM                                                   00005140
      SURB = 0.0                                                        00005150
```

```
      DLT = XIPT(IL+1) - XIPT(IL)                                       00005160
      K = (DLT/DLXI * FN + 1.0) *  5.0                                  00005170
      AK = K                                                            00005180
      DDL = DLT/AK                                                      00005190
      KP1 = K + 1                                                       00005200
      DO 78 JI = 1,KP1                                                  00005210
      AJI = JI - 1                                                      00005220
      XJ(JI) = XIPT(IL) + AJI * DDL                                     00005230
   78 CONTINUE                                                          00005240
C                                                                       00005250
      CALL CODIMA(KP1,XJ,RJ,XIPT,RIPT,M,-1.0)                           00005260
C                                                                       00005270
      DO 79 JR = 1,K                                                    00005280
      DLR(JR) = RJ(JR+1) - RJ(JR)                                       00005290
      DLS     =  SQRT(DLR(JR)**2 + DDL**2)                              00005300
   79 SURB = SURB + DLS                                                 00005310
      SARB(IL+1) = SARB(IL) + SURB                                      00005320
   80 CONTINUE                                                          00005330
      GO TO 82                                                          00005340
   81 SARB(M) = XIPT(M) - XIPT(1)                                       00005350
   82 DEL = SARB(M)/(FN-1.0)                                            00005360
      SURF(1) = 0.0                                                     00005370
      DO 85 I = 1,NN                                                    00005380
   85 SURF(I+1) = SURF(I) + DEL                                         00005390
C                                                                       00005400
      CALL CODIMA (N, SURF, R, SARB, RIPT, M, -1.0)                     00005410
C                                                                       00005420
      RHOX(1) =  R(1)/A0                                                00005430
      DELSQ = DEL * DEL                                                 00005440
      DO 86 I = 1,NN                                                    00005450
   86 RHOX(I+1) =  R(I+1)/A0                                            00005460
C                     COMPUTE GAMA                      **              00005470
   95  DEL = DEL/ A0                                                    00005480
       DELSQ = DEL * DEL                                                00005490
       DO 105 I = 1,N                                                   00005500
      DENM = 2. * RHOX(I) * DEL                                         00005510
      IF(RHOX(I) .EQ. 0.)  GO TO 97                                     00005520
      IF (I .NE. 1) GO TO 98                                            00005530
      GAMA(I) = (3.*(RHOX(I+1) - RHOX(I)) + RHOX(I+1) - RHOX(I+2))/DENM 00005540
      GO TO 105                                                         00005550
   97 GAMA(I)  =  1.E+10                                                00005560
      GO  TO  105                                                       00005570
   98 IF (I .EQ. N) GO TO 100                                           00005580
```

```
      GAMA(I) = (RHOX(I+1) - RHOX(I-1)) /DENM                          00005590
      GO TO 105                                                        00005600
  100 GAMA(I) =(3.*(RHOX(I)-RHOX(I-1)) + RHOX(I-2) - RHOX(I-1)) /DENM  00005610
  105 CONTINUE                                                         00005620
C                                                                      00005630
      IGM  =  GMI                                                      00005640
      GO TO  (125,125,110,1000,1000), IGM                              00005650
C                                                                      00005660
  110 DO 122 I = 1,N                                                   00005670
      IF(RHOX(I) .EQ. 0.)  GO TO 116                                   00005680
      WTH(I) = (SQRT(1. - (GAMA(I) * RHOX(I)) **2 )) /RHOX(I)          00005690
      DENOM = RHOX(I) * WTH(I) * DELSQ                                 00005700
      IF (I .NE. 1) GO TO 112                                          00005710
      WFE(I) =(-2.*RHOX(I)+5.*RHOX(I+1)-4.*RHOX(I+2)+RHOX(I+3))/DENOM  00005720
      GO TO 122                                                        00005730
  112 IF (I .EQ. N) GO TO 115                                          00005740
      WFE(I) = (2. * RHOX(I) - RHOX(I-1) - RHOX(I+1)) /DENOM           00005750
      GO TO 122                                                        00005760
  115 WFE(I) =(-2.*RHOX(I)+5.*RHOX(I-1)-4.*RHOX(I-2)+RHOX(I-3))/DENOM  00005770
      GO  TO  122                                                      00005780
  116 IF(I .EQ. 1)  GO TO 122                                          00005790
  118 WFE(N)  =  WFE(N-1)                                              00005800
      WTH(N)  =  WFE(N)                                                00005810
  122 CONTINUE                                                         00005820
C                                                                      00005830
      IF(RHOX(1) .NE. 0.)  GO TO 125                                   00005840
      WFE(1)  =  WFE(2)                                                00005850
      WTH(1)  =  WFE(1)                                                00005860
C                                                                      00005870
  125 IF (PFLAG .EQ. 0.0) GO TO 1000                                   00005880
C                                                                      00005890
      WRITE (6,130) (I, R(I),          WTH(I), WFE(I), RHOX(I), GAMA(I), 00005900
     1 I = 1,N)                                                        00005910
  130 FORMAT (1H-,9X,1HI,9X,4HR(I),          10X,8HW(THETA),11X,       00005920
     1 5HW(XI),11X,7HRHOX(I),10X,7HGAMA(I) //(I11,1P5E17.7) )          00005930
C                                                                      00005940
 1000 DEL2  =  2. * DEL                                                00005950
      BTA11  =  -S77 * CFE * DEL                                       00005960
      BTA33  =  -S77 * CZ * DEL                                        00005970
C                                                                      00005980
      EN1  =  1.                                                       00005990
 1005 IF(R(1) .NE. 0.)  GO TO 2000                                     00006000
C                                                                      00006010
```

```
      ENI  =  2.                                                        00006020
      DO   1010  I = 1,4                                                00006030
      FM6(I)  =  0.                                                     00006040
      DO   1010  J = 1,4                                                00006050
      FM2(I,J)  =  0.                                                   00006060
 1010 FM4(I,J)  =  0.                                                   00006070
C              FORM UPPER BOUNDARY MATRICES FOR CLOSED SHELL            00006080
      FM4(1,1)  =  1.                                                   00006090
      IF(ENF - 1.) 1120,1130,1140                                       00006100
 1120 EM2(4,4)  =  1. /DEL                                              00006120
 1121 EM2(3,3)  =  1. /DEL                                              00006130
      FM4(2,2)  =  1.                                                   00006140
      GO  TO   2000                                                     00006150
 1130 EM2(2,1)  =  1. /DEL                                              00006160
      EM4(1,2)  =  1.                                                   00006170
 1135 EM4(3,3)  =  1.                                                   00006180
      EM4(4,4)  =  1.                                                   00006190
      GO  TO  2000                                                      00006200
 1140 IF(ENF .NE. 2.)  GO TO 1150                                       00006210
      FM4(4,3)  =  1.                                                   00006220
      GO  TO  1121                                                      00006230
 1150 FM4(2,2)  =  1.                                                   00006240
      GO  TO  1135                                                      00006250
C                                                                       00006260
 2000 RETURN                                                            00006270
      END                                                               00006280
```

```
$IBFTC CF3P                                                                    00006290
C     PARABOLIC CURVE FITTING SUBROUTINE  (THREE POINTS)                       00006300
C                                                                              00006310
      SUBROUTINE CODIM4 (N1, X, Y, XI, YI, N2, SHAPE)                          00006320
C                                                                              00006330
C  ARGUMENTS                                                                   00006340
C     N1          NO. OF POINTS TO ITERPOLATE                                  00006350
C     X           LOCATION OF POINTS TO BE INTERPOLATED                        00006360
C     Y           ANSWERS                                                      00006370
C     XI          INDEPENDENT ARGUMENT                                         00006380
C     YI          DEPENDENT ARGUMENT                                           00006390
C     N2          NO. OF ARGUMENTS                                             00006400
C     SHAPE       0 = FITS END WITH STRAIGHT LINE   1 = CURVE,LAST 3 PTS.      00006410
C                                                                              00006420
      DIMENSION X(1),Y(1),XI(1),YI(1),D(2),A(2),B(2),C(2)                      00006430
C                                                                              00006440
  100 IN = 0                                                                   00006450
      XK = SHAPE                                                               00006460
C                                                                              00006470
      DO 800 N = 1,N1                                                          00006480
C                                                                              00006490
      IF (N2-2) 110,115,120                                                    00006500
  110 Y(N) = YI(N2)                                                            00006510
      GO TO 800                                                                00006520
C                                                                              00006530
  115 Y(N) = (YI(2)-YI(1))/(XI(2)-XI(1))*  (X(N)-XI(1))+YI(1)                  00006540
      GO TO 800                                                                00006550
C                                                                              00006560
  120 J = 1                                                                    00006570
  125 IF(XI(J)-X(N)) 130,140,150                                               00006580
  140 Y(N) = YI(J)                                                             00006590
      GO TO 800                                                                00006600
C                                                                              00006610
  130 J = J+1                                                                  00006620
      IF(J-N2) 125,125,145                                                     00006630
  145 Y(N) = (YI(N2)-YI(N2-1))/(XI(N2)-XI(N2-1))*(X(N)-XI(N2-1))               00006640
     1       + YI(N2 - 1)                                                      00006650
      GO TO 800                                                                00006660
C                                                                              00006670
  150 IF(J-2) 115,155,160                                                      00006680
  155 K = 3                                                                    00006690
      JJ = 1                                                                   00006700
      GO TO 185                                                                00006710
```

```
  160 IF(J-N2) 170,165,145                                          00006720
  165 K = N2-1                                                      00006730
      JJ = 2                                                        00006740
      GO TO 185                                                     00006750
  170 IF(J-IN) 180,300,180                                          00006760
  180 JJ = 3                                                        00006770
      K = J                                                         00006780
C                                                                   00006790
  185 DO 200 M = 1,2                                                00006800
      X1 = XI(K-1)-XI(K)                                            00006810
      X2 = XI(K)-XI(K-2)                                            00006820
      X3 = XI(K-2)-XI(K-1)                                          00006830
      Y1 = YI(K-1)-YI(K)                                            00006840
      Y2 = YI(K)-YI(K-2)                                            00006850
      Y3 = YI(K-2)-YI(K-1)                                          00006860
      XX1 = XI(K-2)**2                                              00006870
      XX2 = XI(K-1)**2                                              00006880
      XX3 = XI(K)**2                                                00006890
      D(M) = XX1*X1 +XX2*X2+ XX3*X3                                 00006900
      A(M) = (YI(K-2)*X1 +YI(K-1)*X2+ YI(K)*X3)/D(M)                00006910
      B(M) = (XX1*Y1 + XX2*Y2+XX3*Y3)/D(M)                          00006920
      C(M) = YI(K-2)- A(M)*XX1 -B(M)*XI(K-2)                        00006930
  200 K = K+1                                                       00006940
  300 P1 = X(N)*(A(1)*X(N)+B(1)) +C(1)                              00006950
      P2 = X(N)*(A(2)*X(N)+B(2)) +C(2)                              00006960
      AL = (X(N)-XI(J-1))/(XI(J)-XI(J-1))                           00006970
      S  = YI(J)*AL + YI(J-1)*(1.0-AL)                              00006980
      GO TO (320,330,350),JJ                                        00006990
C                                                                   00007000
  320 P2 = P1                                                       00007010
      AL = (X(N)-XI(1))/(XI(2)-XI(1))                               00007020
      S = AL*YI(2) + (1.0-AL)*YI(1)                                 00007030
      IF (SHAPE) 321,322, 322                                       00007040
  321 XM1 = ABS (YI(2) - YI(1)) / (XI(2) - XI(1))                   00007050
      XM2 = ABS (YI(3) - YI(2)) / (XI(3) - XI(2))                   00007060
      XK = 1. - ABS (XM1 -XM2) / (XM1 + XM2)                        00007070
  322 P1 = S + XK *(P2-S)                                           00007080
      GO TO 350                                                     00007090
C                                                                   00007100
  330 P1 = P2                                                       00007120
      AL = (X(N)-XI(N2-1))/ (XI(N2)-XI(N2-1))                       00007130
      S = AL* YI(N2) +(1.0-AL)*YI(N2-1)                             00007140
      IF (SHAPE) 331,332, 332                                       00007150
```

```
      331 XM1 = ABS (YI(N2 - 1) - YI(N2)) /(XI(N2 -1) - XI(N2))          00007160
          XM2 = ABS (YI(N2 -2) - YI(N2 -1)) / (XI(N2 -2) - XI(N2 -1))    00007170
          XK = 1. - ABS (XM1 -XM2) / (XM1 + XM2)                         00007180
      332 P2 = S + XK*(P1-S)                                             00007190
C                                                                        00007200
      350 E1 = ABS (P1-S)                                                00007210
          E2 = ABS (P2-S)                                                00007220
          IN = J                                                         00007230
          IF(E1+E2) 700,700,750                                          00007240
      700 Y(N) = S                                                       00007250
          GO TO 800                                                      00007260
      750 YNUM = E1 * AL * P2 + (1. - AL) * E2 * P1                      00007270
          YDEN = E1 * AL + (1. - AL) * E2                                00007280
          Y(N) = YNUM / YDEN                                             00007290
      800 CONTINUE                                                       00007300
C                                                                        00007310
      900 RETURN                                                         00007320
          END                                                            00007330
```

```
$ORIGIN        CHAIN                                                          00007340
$IBFTC CDAFIT                                                                 00007350
C      CURVE FIT SUBROUTINE                                  6J-157DR         00007360
C                                                                             00007370
       SUBROUTINE CRVFIT                                                      00007380
C                                                                             00007390
C      THE NOMENCLATURE IS VERY SIMILAR  TO THAT IN THE DA DATA REGION        00007400
C          AS EXPLAINED IN THE EXECUTIVE PROGRAM.  THE SUFFIX TB (TABLE)      00007410
C          HAS BEEN ADDED TO EACH PARAMETER.                                  00007420
C                                                                             00007430
C      THE TABLES ARE SET UP AS FOLLOWS                                       00007440
C          TAB(1)     NO. OF STATIONS GIVEN                                   00007450
C          TAB(2)     STATION NO. = 1.                                        00007460
C          TAB(3)     PARAMETER VALUE AT STATION 1.                           00007470
C          TAB(4)FF   STATIONS AND VALUES INTERLACED.                         00007480
C      THE LAST STATION MUST BE N BECAUSE CODIMA WILL NOT EXTRAPOLATE         00007490
C                                                                             00007500
       REAL    MASS, MO                                                       00007510
C                                                                             00007520
       DIMENSION  CDA(697), DTB(41), EKTB(41), E1TB(41), ALFTB(41),           00007530
      1  DNATB(41), TTB(41), ENTB(41), EMTB(41), PNTB(41), PFETB(41),         00007540
      2  PTHTB(41), DZOTB(41), VZOTB(41), QZOTB(41), DFOTB(41),               00007550
      3  VFOTB(41), QFOTB(41),                                                00007560
      4  D(200), EK(200), E1(200), ALF(200), DNA(200), T(200), ENT(200),      00007570
      5  EMT(200), PN(200), PFE(200), PTH(200), DZO(200), VZO(200),           00007580
      6  AZO(200), DFO(200), VFO(200), AFO(200), X(200),                      00007590
      7  STA(20), VAL(20)                                                     00007600
C                                                                             00007610
       EQUIVALENCE          (CDA(1),     DTB),   (CDA(42),    EKTB),        00007620
      1(CDA(83),    E1TB),   (CDA(124),  ALFTB),   (CDA(165),  DNATB),       00007630
      2(CDA(206),    TTB),   (CDA(247),   ENTB),   (CDA(288),   EMTB),       00007640
      3(CDA(329),   PNTB),   (CDA(370),  PFETB),   (CDA(411),  PTHTB),       00007650
      4(CDA(452),  DZOTB),   (CDA(493),  VZOTB),   (CDA(534),  QZOTB),       00007660
      5(CDA(575),  DFOTB),   (CDA(616),  VFOTB),   (CDA(657),  QFOTB)        00007670
C                                                                             00007680
       EQUIVALENCE      (DA(1),  FN   ),(DA(25),  MASS ),(DA(1040),  D  ),   00007690
      1(DA(1240),  EK ),(DA(1440), E1 ),(DA(1640), ALF ),(DA(1840), DNA),    00007700
      2(DA(2040),  T  ),(DA(2240), ENT),(DA(2440), EMT ),(DA(2640), PN ),    00007710
      3(DA(2840), PFE ),(DA(3040), PTH),(DA(3240), DZO ),(DA(3440), VZO),    00007720
      4(DA(3640), AZO ),(DA(3840), DFO),(DA(4040), VFO ),(DA(4240), AFO),    00007730
      5(DA(3),    HO  ),(DA(4),    EO  ),(DA(8),    PO  ),(DA(6),   ENFO ),   00007740
      6(DA(36), RESTRT)                                                       00007750
C                                                                             00007760
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      COMMON   DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, ELAM2,      00007770
     1  Z(4,200),XX(4,2..), A2(4,4), B2(4,4), C2(4,4), GZ(4), E(4,4),     00007780
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,       00007790
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                           00007800
     4  S77, S78, BTA11, BTA33, MO(200), OMG2(200), ZP(3,200),           00007810
     5  Z2P(3,200), Z3P(3,200), TIMX, TDEL, PRNT, FNF, PRT, JT, NJT, V1  00007820
     6  ,XXX(2800),INDER,ICYL,                                           00007830
     1  JELLO ,IVX, CONV, NO, IV, NOT, PE2( 75), PS( 75), PM1( 75),      00007840
     2 P(4, 75), PP(4, 75), FUN(4), RH, RHO, WT, GAM, GMU( 75), BP,AP,   00007850
     3  VEL,ACC,R1,ZAP,PIE,RADIUS,NSTART,NSAVE                           00007860
     4  ,KODES1,KODES2,KODER1,KODER2                                     00007870
C                                                                       00007880
      N  =  FN                                                          00007890
      S3  =  F0 * H0 *(1. - P0I **2)                                    00007900
      DO  50     I = 1,697                                              00007910
   50 CDA(I)  =  0.                                                     00007920
C                                                                       00007930
      IF(NSTART.EQ.0) GO TO 65                                          00007940
      READ(12) KODE S1                                                  00007950
      IF(KODES1.NE.KODES2) GO TO 5513                                   00007960
      READ(12) (OMG2(I),I=1,2002),INDER,ICYL,JELLO,IVX,CONV,NO,IV,NOT,  00007970
     1              (PE2(I),I=1,918),                                   00007980
     3      (DA(I),I=2640,2839),                                       00007990
     2      (DA(I),I=3240,3439),(DA(I),I=3840,4039)                    00008000
      REWIND 12                                                         00008010
      IV=1                                                              00008020
      JELLO=0                                                           00008030
      TIMX  =  TIMX + TDEL                                              00008040
      JI  =  TIMX /TDEL + 1.E-6                                         00008050
      PRNT  =  JT                                                       00008060
C                                                                       00008070
   65 CALL DECRD ( CDA )                                                00008080
C                                        PRINT TABLES ON NEG. IND.      00008090
      IF(DTB .EQ. 0.)  GO TO 90                                         00008100
C                                                                       00008110
      WRITE ( 6,70)  (I, DTB(I), EKTB(I), E1TB(I), ALFTB(I), DNATB(I),  00008120
     1              TTB(I), ENTB(I), EMTB(I),  I = 1,41)                00008130
   70 FORMAT(///10X, 16HCURVE FIT TABLES ///14X,3HDTB, 8X,4HEKTB, 8X,   00008140
     1 4HE1TB, 8X,5HALFTB, 7X,5HDNATB, 8X,3HTTB, 8X,4HENTB, 8X,4HEMTB //00008150
     2     (I8, 1P8E12.3)  )                                            00008160
C                                                                       00008170
      WRITE ( 6,72)  (I, PNTB(I), PFETB(I), PTHTB(I), DZOTB(I),         00008180
     1    VZOTB(I), QZOTB(I), DFOTB(I), VFOTB(I), QFOTB(I),  I = 1,41)  00008190
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      72 FORMAT(/// 11X,4HPNIB, 6X,5HPEEIB, 6X,5HPIHIB, 6X,5HDZOIB, 6X,     00008200
     1  5HVZOTB, 6X,5HQZOTB, 6X,5HDFOTB, 6X,5HVFOTB, 6X,5HQFOTB //           00008210
     2       (I6, 1P9E11.2)  )                                              00008220
C                                                FORM COL. OF STATION NOS.  00008230
      90 DO   92    I = 1,N                                                  00008240
      92 X(I)  =  I                                                         00008250
C                                                                           00008260
     100 IF(DTB .NE. 1.E+10)  GO TO 120                                     00008270
         DO  105    I = 1,N                                                 00008280
     105 D(I)  =  DTB(2)                                                    00008290
         GO  TO  200                                                        00008300
C                                                                           00008310
     120 IF(DTB .EQ. 0.)  GO TO 600                                         00008320
         NOSTA  =  DTB                                                      00008330
         ICDA  =  1                                                         00008340
         IDA   =  1040                                                      00008350
         IXX   =  1                                                         00008360
         GO  TO   2000                                                      00008370
C                                                                           00008380
     200 IF(EKTB .NE. 1.E+10) GO TO 220                                     00008390
         DO   205    I = 1,N                                                00008400
     205 EK(I)  =  EKTB(2)                                                  00008410
         GO  TO  300                                                        00008420
C                                                                           00008430
     220 NOSTA  =  EKTB                                                     00008440
         ICDA  =  42                                                        00008450
         IDA   =  1240                                                      00008460
         IXX   =  2                                                         00008470
         GO TO    2000                                                      00008480
C                                                                           00008490
     300 IF(E1TB .NE. 1.E+10) GO TO 320                                     00008500
         DO   305    I = 1,N                                                00008510
     305 E1(I)  =  E1TB(2)                                                  00008520
         GO  TO  400                                                        00008530
C                                                                           00008540
     320 NOSTA  =  E1TB                                                     00008550
         ICDA  =  83                                                        00008560
         IDA   =  1440                                                      00008570
         IXX   =  3                                                         00008580
         GO  TO  2000                                                       00008590
C                                                                           00008600
     400 IF(ALFTB .NE. 1.E+10) GO TO 420                                    00008610
         DO   405    I = 1,N                                                00008620
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  405 ALF(I)  =  ALFTB(2)                                          00008630
      GO  TO  500                                                  00008640
C                                                                  00008650
  420 IF(ALFTB .EQ. 0.)  GO TO 500                                 00008660
      NOSTA  =  ALFTB                                              00008670
      ICDA  =  124                                                 00008680
      IDA  =  1640                                                 00008690
      IXX  =  4                                                    00008700
      GO  TO  2000                                                 00008710
C                                                                  00008720
  500 IF(DNATB .NE. 1.E+10) GO TO 520                              00008730
      DO  505  I = 1,N                                             00008740
      DMA(I)  =  DNATB(2)                                          00008750
  505 MO(I)  =  MASS * D(I) /EI(I) * S3                            00008760
      GO  TO  600                                                  00008770
C                                                                  00008780
  520 NOSTA  =  DNATB                                              00008790
      ICDA  =  165                                                 00008800
      IDA  =  1840                                                 00008810
      IXX  =  5                                                    00008820
      GO  TO  2000                                                 00008830
C                                                                  00008840
  580 DO  582  I = 1,N                                             00008850
  582 MO(I)  =  MASS * D(I) /EI(I) * S3                            00008860
C                                                                  00008870
  600 IF(TTB .NE. 1.E+10) GO TO 620                                00008880
      DO  605  I = 1,N                                             00008890
  605 T(I)  =  TTB(2)                                              00008900
      GO  TO  700                                                  00008910
C                                                                  00008920
  620 IF( TTB )  622,900,630                                       00008930
  622 NOSTA  =  -TTB                                               00008940
      ICDA  =  206                                                 00008950
      IDA  =  2040                                                 00008960
      IXX  =  6                                                    00008970
      GO  TO  2000                                                 00008980
C                                                                  00008990
  630 DO  632  I = 1,N                                             00009000
  632 T(I)  =  FNTERP( X(I), ITB)                                  00009010
C                                                                  00009020
  700 IF(ENTB .NE. 1.E+10) GO TO 720                               00009030
      DO  705  I = 1,N                                             00009040
  705 ENT(I)  =  ENTB(2)                                           00009050
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      GO  TO  800                                                    00009060
C                                                                    00009070
  720 IF( ENTB )   722,800,730                                       00009080
  722 NOSTA  = -ENTB                                                 00009090
      ICDA   =  247                                                  00009100
      IDA    =  2240                                                 00009110
      IXX    =  7                                                    00009120
      GO  TO  2000                                                   00009130
C                                                                    00009140
  730 DO  732    I = 1,N                                             00009150
  732 ENT(I)  =  ENTERP( X(I), ENTB)                                 00009160
C                                                                    00009170
  800 IF(EMTB .NE. 1.E+10) GO TO 820                                 00009180
      DO  805    I = 1,N                                             00009190
  805 EMT(I)  =  EMTB(2)                                             00009200
      GO  TO  900                                                    00009210
C                                                                    00009220
  820 IF( EMTB )    822,900,830                                      00009230
  822 NOSTA  = -EMTB                                                 00009240
      ICDA   =  288                                                  00009250
      IDA    =  2440                                                 00009260
      IXX    =  8                                                    00009270
      GO  TO  2000                                                   00009280
C                                                                    00009290
  830 DO  832    I = 1,N                                             00009300
  832 EMT(I)  =  ENTERP( X(I), EMTB)                                 00009310
C                                                                    00009320
  900 IF(PNTB .NE. 1.E+10) GO TO 920                                 00009330
      DO  905    I = 1,N                                             00009340
  905 PN(I)  =  PNTB(2)                                              00009350
      GO  TO  1000                                                   00009360
C                                                                    00009370
  920 IF( PNTB )    922,1000,930                                     00009380
  922 NOSTA  = -PNTB                                                 00009390
      ICDA   =  329                                                  00009400
      IDA    =  2640                                                 00009410
      IXX    =  9                                                    00009420
      GO  TO  2000                                                   00009430
C                                                                    00009440
  930 DO  932    I = 1,N                                             00009450
  932 PN(I)  =  ENTERP( X(I), PNTB)                                  00009460
C                                                                    00009470
 1000 IF(PFETB .NE. 1.E+10) GO TO 1020                               00009480
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      DO  1005   I = 1,N                                          00009490
 1005 PFF(I)  =  PFFTB(2)                                        00009500
      GO  TO  1100                                               00009510
C                                                                00009520
 1020 IF( PFETB )    1022,1100,1030                              00009530
 1022 NOSTA  =  -PFFTB                                           00009540
      ICDA   =  370                                              00009550
      IDA    =  2840                                             00009560
      IXX    =  10                                               00009570
      GO  TO  2000                                               00009580
C                                                                00009590
 1030 DO  1032   I = 1,N                                         00009600
 1032 PFE(I)  =  FNTERP( X(I), PFETB)                            00009610
C                                                                00009620
 1100 IF(PTHTB .NE. 1.E+10) GO TO 1120                           00009630
      DO  1105   I = 1,N                                         00009640
 1105 PTH(I)  =  PTHTB(2)                                        00009650
      GO  TO 1200                                                00009660
C                                                                00009670
 1120 IF( PTHTB )    1122,1200,1130                              00009680
 1122 NOSTA  =  -PTHTB                                           00009690
      ICDA   =  411                                              00009700
      IDA    =  3040                                             00009710
      IXX    =  11                                               00009720
      GO  TO  2000                                               00009730
C                                                                00009740
 1130 DO  1132   I = 1,N                                         00009750
 1132 PTH(I)  =  FNTERP( X(I), PTHTB)                            00009760
C                                                                00009770
 1200 IF(DZOTB .NE. 1.E+10) GO TO 1220                           00009780
      DO  1205   I = 1,N                                         00009790
 1205 DZO(I)  =  DZOTB(2)                                        00009800
      GO  TO  1300                                               00009810
C                                                                00009820
 1220 IF( DZOTB )    1222,2100,1230                              00009830
 1222 NOSTA  =  -DZOTB                                           00009840
      ICDA   =  452                                              00009850
      IDA    =  3240                                             00009860
      IXX    =  12                                               00009870
      GO  TO  2000                                               00009880
C                                                                00009890
 1230 DO  1232   I = 1,N                                         00009900
 1232 DZO(I)  =  FNTERP( X(I), DZOTB)                            00009910
```

```
C                                                                       00009920
 1300 IF(VZOTB .NE. 1.E+10) GO TO 1320                                  00009930
      DO  1305   I = 1,N                                                00009940
 1305 VZO(I)  =  VZOTB(2)                                               00009950
      GO  TO  1400                                                      00009960
C                                                                       00009970
 1320 IF( VZOTB )    1322,1400,1330                                     00009980
 1322 NOSTA  =  -VZOTB                                                  00009990
      ICDA   =  493                                                     00010000
      IDA    =  3440                                                    00010010
      IXX    =  13                                                      00010020
      GO  TO  2000                                                      00010030
C                                                                       00010040
 1330 DO  1332   I = 1,N                                                00010050
 1332 VZO(I)  =  ENTERP( X(I), VZOTB)                                   00010060
C                                                                       00010070
 1400 IF(QZOTB .NE. 1.E+10) GO TO 1420                                  00010080
      DO  1405   I = 1,N                                                00010090
 1405 AZO(I)  =  QZOTB(2) /MO(I)                                        00010100
      GO  TO  1500                                                      00010110
C                                                                       00010120
 1420 IF( QZOTB )    1422,1500,1430                                     00010130
 1422 NOSTA  =  -QZOTB                                                  00010140
      ICDA   =  534                                                     00010150
      IDA    =  3640                                                    00010160
      IXX    =  14                                                      00010170
      GO  TO  2000                                                      00010180
C                                                                       00010190
 1430 DO  1432   I = 1,N                                                00010200
      QZO  =  ENTERP( X(I), QZOTB)                                      00010210
 1432 AZO(I)  =  QZO /MO(I)                                             00010220
      GO  TO  1500                                                      00010230
C                                                                       00010240
 1480 DO  1482   I = 1,N                                                00010250
 1482 AZO(I)  =  AZO(I) /MO(I)                                          00010260
C                                                                       00010270
 1500 IF(DFOTB .NE. 1.E+10) GO TO 1520                                  00010280
      DO  1505   I = 1,N                                                00010290
 1505 DFO(I)  =  DFOTB(2)                                               00010300
      GO  TO  1600                                                      00010310
C                                                                       00010320
 1520 IF( DFOTB )    1522,1600,1530                                     00010330
 1522 NOSTA  =  -DFOTB                                                  00010340
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      ICDA   =  575                                                    00010350
      IDA    =  3840                                                   00010360
      IXX    =  15                                                     00010370
      GO  TO  2000                                                     00010380
C                                                                      00010390
 1530 DO  1532   I = 1,N                                               00010400
 1532 DF0(I)  =  FNTERP( X(I), DFOTB)                                  00010410
C                                                                      00010420
 1600 IF(VFOTB .NE. 1.E+10) GO TO 1620                                 00010430
      DO  1605   I = 1,N                                               00010440
 1605 VF0(I)  =  VFOTB(2)                                              00010450
      GO  TO  1700                                                     00010460
C                                                                      00010470
 1620 IF( VFOTB )    1622,1700,1630                                    00010480
 1622 NOSTA  =  -VFOTB                                                 00010490
      ICDA   =  616                                                    00010500
      IDA    =  4040                                                   00010510
      IXX    =  16                                                     00010520
      GO  TO  2000                                                     00010530
C                                                                      00010540
 1630 DO  1632   I = 1,N                                               00010550
 1632 VF0(I)  =  FNTERP( X(I), VFOTB)                                  00010560
C                                                                      00010570
 1700 IF(QFOTB .NE. 1.E+10) GO TO 1720                                 00010580
      DO  1705   I = 1,N                                               00010590
 1705 AF0(I)  =  QFOTB(2) /M0(I)                                       00010600
      GO  TO  2100                                                     00010610
C                                                                      00010620
 1720 IF( QFOTB )    1722,2100,1730                                    00010630
 1722 NOSTA  =  -QFOTB                                                 00010640
      IDA    =  657                                                    00010650
      IDA    =  4240                                                   00010660
      IXX    =  17                                                     00010670
      GO  TO  2000                                                     00010680
C                                                                      00010690
 1730 DO  1732   I = 1,N                                               00010700
      QF0  =  FNTERP( X(I), QFOTB)                                     00010710
 1732 AF0(I)  =  QF0 /M0(I)                                            00010720
      GO  TO  2100                                                     00010730
C                                                                      00010740
 1780 DO  1782   I = 1,N                                               00010750
 1782 AF0(I)  =  AF0(I) /M0(I)                                         00010760
      GO  TO  2100                                                     00010770
```

```
C                                                                       00010780
 2000 K0  =  0                                                          00010790
      K2  =  2 * NOSTA                                                  00010800
      DO  2005   I = 2,K2,2                                             00010810
      K0  =  K0 + 1                                                     00010820
      KX  =  ICDA + I - 1                                               00010830
      STA(K0)  =  CDA(KX)                                               00010840
 2005 VAL(K0)  =  CDA(KX+1)                                             00010850
      CALL CODIM4  (N,X,DA(IDA),  STA,VAL,NOSTA,  1.)                   00010860
C                                                                       00010870
      GO TO (200, 300, 400, 500, 58 , 7 , 8  , 9  , 1  , 11  , 12 ,    00010880
     1  1300, 1400, 1480, 1600, 17 , 178 ), IXX                         00010890
C                                                                       00010900
 2100 IF(TIMX .NE. TDEL)  GO TO 3050                                    00010910
      IF(ENF .NE. ENF0) GO TO 5000                                      00010920
      TDEL2  =  TDEL **2                                                00010930
      DO  2110  I = 1,N                                                 00010940
      OMG2(I)  =  S77 * M0(I) * S78                                     00010950
      ZP(1,I)  =  DF0(I)                                                00010960
      ZP(3,I)  =  DZ0(I)                                                00010970
      Z2P(1,I)  =  AF0(I) * TDEL2 + 2. * DF0(I)                         00010980
      Z2P(3,I)  =  AZ0(I) * TDEL2 + 2. * DZ0(I)                         00010990
      Z3P(1,I)  =  6. * (AF0(I)*TDEL2 + VF0(I)*TDEL) + 9. * DF0(I)      00011000
 2110 Z3P(3,I)  =  6. * (AZ0(I)*TDEL2 + VZ0(I)*TDEL) + 9. * DZ0(I)      00011010
C                                                  PRINT INITIAL CONDITIONS  00011020
      WRITE (6,3000)  (DA(I), I=1,32), DA(4441), DA(4477), (I, D(I),    00011030
     1  EK(I), E1(I), ALF(I), DNA(I), I(I), ENT(I), EMT(I), I = 1,N)     00011040
 3000 FORMAT( 1H1//10X, 12HINITIAL DATA// 6X,7HEN    =,1PE12.3, 8X,     00011050
     1  7HA0   =,E12.3, 8X,7HH0   =,E12.3, 8X,7HE    =,E12.3// 6X,      00011060
     2  7HSIG0  =,E12.3, 8X,7HENF0  =,E12.3, 8X,7HENFL  =,E12.3, 8X,     00011070
     3  7HPOI   =,E12.3// 6X,7HTHETA =,E12.3, 8X,7HPIXI  =,E12.3, 8X,    00011080
     4  7HSPRL  =,E12.3, 8X,7HUK    =,E12.3// 6X,7HVK    =,E12.3, 8X,    00011090
     5  7HWK    =,E12.3, 8X,7HEMK   =,E12.3, 8X,7HTAU1  =,E12.3 // 6X,   00011100
     6  7HENT1  =,E12.3, 8X,7HPI1   =,E12.3, 8X,7HTAU2  =,E12.3, 8X,     00011110
     7  7HENT2  =,E12.3// 6X,7HPI2   =,E12.3, 8X,7HTAU3  =,E12.3, 8X,    00011120
     8  7HENT3  =,E12.3, 8X,7HPI3   =,E12.3// 6X,7HMASS  =,E12.3, 8X,    00011130
     9  7HCFE   =,E12.3, 8X,7HCZ    =,E12.3, 8X,7HSKFE  =,E12.3// 6X,     00011140
     X  7HSKZ   =,E12.3, 8X,7HSUM   =,E12.3, 8X,7HEN1   =,E12.3 , 8X,    00011150
     1  7HDEL   =,E12.3// 6X,7HBCITP =,E12.3, 8X,7HBCIBM =,E12.3/// 15X,  00011160
     2  1HD, 10X,2HEK, 10X,2HE1, 10X,3HALF, 9X,3HDNA, 10X,1HT, 10X,      00011170
     3  3HENT, 9X,3HEMT // (I8, 8E12.3) )                               00011180
      WRITE  (6,3005)  (I, PN(I), PFF(I), PTH(I), DZ0(I), VZ0(I),       00011190
     1                  AZ0(I) , DF0(I), VF0(I), AF0(I),  I = 1,N)      00011200
```

```
 3005 FORMAT(/// 12X,2HPN, 8X,3HPFE, 8X,3HPTH, 8X,3HDZ0, 8X,3HVZ0, 8X,  00011210
     1  3HAZ0, 8X,3HDF0, 8X,3HVF0, 8X,3HAF0 // (I6, 1P9E11.2) )          00011230
C                                                                       00011240
      GO TO 5000                                                        00011250
 3050 CONTINUE                                                          00011260
 5000 RETURN                                                            00011270
 5513 WRITE( 6,5514) KODES1,KODES2                                      00011280
 5514 FORMAT(1H0,54HINPUT COMMON IS WRONG--CHECK TAPE NOS.--KODES1,KODE 00011290
     1S2=,2I12)                                                         00011300
      STOP                                                              00011310
      END                                                               00011320
```

```
$IBFTC CODS                                                                    00011330
C       PARABOLIC CURVE FITTING SUBROUTINE  (THREE POINTS)                     00011340
C                                                                              00011350
        SUBROUTINE CODIMA (N1, X, Y, XI, YI, N2, SHAPE)                        00011360
C                                                                              00011370
C  ARGUMENTS                                                                   00011380
C       N1          NO. OF POINTS TO INTERPOLATE                               00011390
C       X           LOCATION OF POINTS TO BE INTERPOLATED                      00011400
C       Y           ANSWERS                                                    00011410
C       XI          INDEPENDENT ARGUMENT                                       00011420
C       YI          DEPENDENT ARGUMENT                                         00011430
C       N2          NO. OF ARGUMENTS                                           00011440
C       SHAPE       0 = FITS END WITH STRAIGHT LINE   1 = CURVE,LAST 3 PTS.    00011450
C                                                                              00011460
        DIMENSION X(1),Y(1),XI(1),YI(1),D(2),A(2),B(2),C(2)                    00011470
C                                                                              00011480
  100   IN = 0                                                                 00011490
        XK = SHAPE                                                             00011500
C                                                                              00011510
        DO 800 N = 1,N1                                                        00011520
C                                                                              00011530
        IF (N2-2) 110,115,120                                                  00011540
  110   Y(N) = YI(N2)                                                          00011550
        GO TO 800                                                              00011560
C                                                                              00011570
  115   Y(N) = (YI(2)-YI(1))/(XI(2)-XI(1))*  (X(N)-XI(1))+YI(1)                00011580
        GO TO 800                                                              00011590
C                                                                              00011600
  120   J = 1                                                                  00011610
  125   IF(XI(J)-X(N)) 130,140,150                                             00011620
  140   Y(N) = YI(J)                                                           00011630
        GO TO 800                                                              00011640
C                                                                              00011650
  130   J = J+1                                                                00011660
        IF(J-N2) 125,125,145                                                   00011670
  145   Y(N) = (YI(N2)-YI(N2-1))/(XI(N2)-XI(N2-1))*(X(N)-XI(N2-1))             00011680
     1        + YI(N2 - 1)                                                     00011690
        GO TO 800                                                              00011700
C                                                                              00011710
  150   IF(J-2) 115,155,160                                                    00011720
  155   K = 3                                                                  00011730
        JJ = 1                                                                 00011740
        GO TO 185                                                              00011750
```

```
  160 IF(J-N2) 170,165,140                                          00011760
  165 K = N2-1                                                      00011770
      JJ = 2                                                        00011780
      GO TO 185                                                     00011790
  170 IF(J-IN) 180,300,180                                          00011800
  180 JJ = 3                                                        00011810
      K = J                                                         00011820
C                                                                   00011830
  185 DO 200 M = 1,2                                                00011840
      X1 = XI(K-1)-XI(K)                                            00011850
      X2 = XI(K)-XI(K-2)                                            00011860
      X3 = XI(K-2)-XI(K-1)                                          00011870
      Y1 = YI(K-1)-YI(K)                                            00011880
      Y2 = YI(K)-YI(K-2)                                            00011890
      Y3 = YI(K-2)-YI(K-1)                                          00011900
      XX1 = XI(K-2)**2                                              00011910
      XX2 = XI(K-1)**2                                              00011920
      XX3 = XI(K)**2                                                00011930
      D(M) = XX1*X1 +XX2*X2+ XX3*X3                                 00011940
      A(M) = (YI(K-2)*X1 +YI(K-1)*X2+ YI(K)*X3)/D(M)                00011950
      B(M) = (XX1*Y1 + XX2*Y2+XX3*Y3)/D(M)                          00011960
      C(M) = YI(K-2)- A(M)*XX1 -B(M)*XI(K-2)                        00011970
  200 K = K+1                                                       00011980
  300 P1 = X(N)*(A(1)*X(N)+B(1)) +C(1)                              00011990
      P2 = X(N)*(A(2)*X(N)+B(2)) +C(2)                              00012000
      AL = (X(N)-XI(J-1))/(XI(J)-XI(J-1))                           00012010
      S = YI(J)*AL + YI(J-1)*(1.-AL)                                00012020
      GO TO (320,330,350),JJ                                        00012030
C                                                                   00012040
  320 P2 = P1                                                       00012050
      AL = (X(N)-XI(1))/(XI(2)-XI(1))                               00012060
      S = AL*YI(2) + (1.0-AL)*YI(1)                                 00012070
      IF (SHAPE) 321,322, 322                                       00012080
  321 XM1 = ABS (YI(2) - YI(1)) / (XI(2) - XI(1))                   00012090
      XM2 = ABS (YI(3) - YI(2)) / (XI(3) - XI(2))                   00012100
      XK = 1. - ABS (XM1 -XM2) / (XM1 + XM2)                        00012110
  322 P1 = S + XK *(P2-S)                                           00012120
      GO TO 350                                                     00012130
C                                                                   00012140
  330 P1 = P2                                                       00012150
      AL = (X(N)-XI(N2-1))/ (XI(N2)-XI(N2-1))                       00012160
      S = AL* YI(N2) +(1.0-AL)*YI(N2-1)                             00012170
      IF (SHAPE) 331,332, 332                                       00012180
```

```
  331 XM1 = ABS ((XI(N2 - 1) - YI(N2)) /(XI(N2 -1) - XI(N2))                00012190
      XM2 = ABS (YI(N2 -2) - YI(N2 -1)) / (XI(N2 -2) - XI(N2 -1))          00012200
      XK = 1. - ABS (XM1 -XM2) / (XM1 + XM2)                               00012210
  332 P2 = S + XK*(P1-S)                                                   00012220
C                                                                          00012230
  350 E1 = ABS (P1-S)                                                      00012240
      E2 = ABS (P2-S)                                                      00012250
      IN = J                                                               00012260
      IF(E1+E2) 700,700,750                                                00012270
  700 Y(N) = S                                                             00012280
      GO TO 800                                                            00012290
  750 YNUM = E1 * AL * P2 + (1. - AL) * E2 * P1                            00012300
      YDEN = E1 * AL + (1. - AL) * E2                                      00012310
      Y(N) = YNUM / YDEN                                                   00012320
  800 CONTINUE                                                             00012330
C                                                                          00012340
  900 RETURN                                                               00012350
      END                                                                  00012360
```

```
$IBFTC ENTP                                                                    00012370
C       LINEAR  INTERPOLATION  SUBROUTINE **ENTERP**              6J-997      00012380
C                                                                              00012390
C       SELECTS THE VALUE AT EITHER END OF TABLE WHEN ARGUMENT EXCEEDS         00012400
C       LIMIT, THEN CONTINUES                                                  00012410
C                                                                              00012420
C  SUBROUTINE ARGUMENTS                                                        00012430
C       X           VALUE TO LOOK UP IN TABLE                                  00012440
C       TAB(1)      NO. OF PAIRS OF ARGUMENTS AND VALUES IN TABLE              00012450
C       TAB(2),ETC ARGUMENTS AND FUNCTIONS INTERLACED                          00012460
C                                                                              00012470
        FUNCTION ENTERP (X,TAB)                                                00012480
C                                                                              00012490
        DIMENSION TAB(101)                                                     00012500
        IF (TAB) 9,9,8                                                         00012510
      9 ENTERP = - TAB                                                         00012520
        RETURN                                                                 00012530
      8 N = TAB                                                                00012540
        DO 5 I=1,N                                                             00012550
      1 IF (TAB(2*I)-X) 5,4,3                                                  00012560
      3 IF (I-1) 6,6,7                                                         00012570
      7 ENTERP = TAB(2*I-1) + (X-TAB(2*I-2)) * (TAB(2*I+1) - TAB(2*I-1))       00012580
       V    / (TAB(2*I) - TAB(2*I-2))                                         00012590
        RETURN                                                                 00012600
      4 ENTERP = TAB(2*I+1)                                                    00012610
        RETURN                                                                 00012620
      5 CONTINUE                                                               00012630
        M = 2*N+1                                                              00012640
        K = M                                                                  00012650
    105 WRITE ( 6,10)   X, TAB(K)                                              00012660
     10 FORMAT (// 10X,.39HLIMITS OF TABLE EXCEEDED BY ARGUMENT = 1PE12.4      00012670
       1 / 10X, E12.4, 24H = VALUE USED FROM TABLE  )                          00012680
        ENTERP = TAB(K)                                                        00012690
        RETURN                                                                 00012700
      6 M = 2*N+1                                                              00012710
        K = 3                                                                  00012720
        GO TO 105                                                              00012730
        END                                                                    00012740
```

```
$ORIGIN        CHAIN                                                          00012750
$IBFTC ACCN2                                                                  00012760
C         CALCULATION OF SYMMETRIC HYDRO-ELASTIC IMPACT                       00012770
          SUBROUTINE  ACCN                                                    00012780
          DIMENSION PM(200), ZDOT(3,200), CON2(4), CON3(4), RA(200)           00012790
         1 ,DETINT(4)  , TINTL(4) , PM2( 75) ,ZDO2(3,200) , CON2I(4),         00012800
         2   CON3I(4)                                                         00012810
          COMMON DA(8520),I,TDEL,PRNT(3), JT,NJT,V1,X(2800),INDER,ICYL,       00012820
         1  JELLO ,IVX, CONV, NO, IV, NOT, PE2( 75), PS( 75), PM1( 75),       00012830
         2 P(4, 75), PP(4, 75), FUN(4), RH, RHO, WT, GAM, GMU( 75), B, A,     00012840
         3  VEL, ACC, RI, Z  ,PIE,R                                          00012850
          EQUIVALENCE (DA(32),DEL),(DA(34),VIN),(DA(44 ),WFF),(DA(2640),PM),  00012860
         1(DA(3240),ZDOT),(DA(35),IND) ,(DA(3840),ZDO2), (DA( 4  ), RA)       00012870
C         VIN IS THE INITIAL VELOCITY, I/S.DEL IS THE RADIAL INCRIMENT        00012880
C         THE RADIUS OF CURVATURE, R, IS EQUAL TO 1/WFF.  RHO IS THE LIQUID   00012890
C         DENSITY, LBS/I**3.  WT IS THE WEIGHT OF THE ENTERING BODY.          00012900
          IF ( IND.EQ. 0)  GO TO 300                                          00012910
          IF (JT.GT.1) GO TO 900                                              00012920
          B=0.                                                                00012930
          ACC=0.                                                              00012940
          VEL=VIN                                                             00012950
          GO TO 940                                                           00012960
      900 FORCE = PIE*RA(1)**2/4.*PM(1)                                       00012970
          DO 910 I=2,NOT                                                      00012980
          WEL = (RA(I)-RA(I-1))/ 2.                                           00012990
      910 FORCE = FORCE + 4.*PIE*WEL*RA(I)*PM(I)                              00013000
          ACC = FORCE/WT                                                      00013010
      940 VEL=VEL+ TDEL*ACC*32.2*12.                                          00013020
          B=B+ VEL*TDEL +ACC*32.2*6.*TDEL**2                                  00013030
          A= (2.*R*B)**.5                                                     00013040
          NO=A/DEL+1.                                                         00013050
          IF ( NO .EQ. 1) GO TO 10                                            00013060
          DO 1 N=2,NO                                                         00013070
          GMU(N)=(1.-(RA(N)/A)**2)**.5                                        00013080
          P(1,N)=GMU(N)                                                       00013090
          PP(1,N)=1.                                                          00013100
          P(2,N)=.5*(5.*GMU(N)**3-3.*GMU(N)  )                                00013120
          PP(2,N)=.5*(15.*GMU(N)**2-3.)                                       00013130
          P(3,N)=.125*(63.*GMU(N)**5-70.*GMU(N)**3+15.*GMU(N))                00013140
          PP(3,N)=.125*(315.*GMU(N)**4-210.*GMU(N)**2+15.)                    00013150
          P(4,N)= 1./16.*(429.*GMU(N)**7-693.*GMU(N)**5+315.*GMU(N)**3-35.*   00013160
         1GMU(N))                                                             00013170
        1 PP(4,N)=1./16.*(7.*429.*GMU(N)**6-5.*693.*GMU(N)**4+315.*3.*GMU(N)  00013180
```

```
     1**2-35. )                                                                  00013190
  10 IF( A-RA(NO) .LT. DEL/2.)  GO TO 100                                       00013200
     NOT = NO + 1                                                               00013210
     GO TO 102                                                                  00013220
 100 NOT = NO                                                                   00013230
     IF ( NO .GT. 1) GO TO 102                                                  00013240
     R1=0.                                                                      00013250
     Z=1.                                                                       00013260
     GO TO 103                                                                  00013270
 102 R1 = RA(NOT) - DEL/2.                                                      00013280
     Z=  (1.-(R1/A)**2)**.5                                                     00013290
     LET = NOT - 1                                                              00013300
     DO 110 I = 1,LET                                                           00013310
     CON =-2./ PIE* ( VEL**2*R/A/GMU(I) + A*GMU(I) * ACC )                      00013320
 110  PM1(I)=   RH  * CON                                                       00013330
 103 PM1(NOT)= -2./PIE*VEL**2/DEL*R*RH*(PIE/2.-ARSIN(R1/A))                    00013340
    1  -1./PIE*ACC*A*RH/DEL*(-R1*Z+ A*PIE/2. - A*ARSIN(R1/A))                  00013350
     NOP=NO+2                                                                   00013360
     DO 120 L = 1, NOP                                                          00013370
 120 ZDOT(3,L)  =  ZDOT(3,L)   +  TDEL*ZDO2(3,L)                                00013380
 300 IF (NO .LT.2)     GO TO 305                                                00013390
      IF  (NO.GT. 3)   GO TO 310                                                00013400
     BE=(ZDOT(3,NO)- ZDOT(3,1))/(GMU(NO)- 1. )                                  00013410
     AE = ZDOT(3,1)- BE                                                         00013420
     CE =0.                                                                     00013430
     DF = 0.                                                                    00013440
     BA=(ZDO2(3,NO)- ZDO2(3,1))/(GMU(NO)- 1. )                                  00013450
     AA = ZDO2(3,1)- BA                                                         00013460
     CA = 0.                                                                    00013470
     DA = 0.                                                                    00013480
     GO TO 320                                                                  00013490
 305 AF = ZDOT(3,1)                                                             00013500
     BE = 0.                                                                    00013510
     DF = 0.                                                                    00013520
     CE =0.                                                                     00013530
     AA = ZDO2(3,1)                                                             00013540
     BA = 0.                                                                    00013550
     CA = 0.                                                                    00013560
     DA = 0.                                                                    00013570
     GO TO 320                                                                  00013580
 310 N1= NO/3 +1                                                                00013590
     N2= 2*NO/3+1                                                               00013600
     E2=(ZDOT(3,N1)-ZDOT(3,1))/(GMU(N1)-1.)- (ZDOT(3,N2)- ZDOT(3,1))/(          00013610
```

```
     1GMU(N2)-1.)                                                                00013620
      E3=' (ZDOT(3,N1)-ZDOT(3,1))/(GMU(N1)-1. )  -(ZDOT(3,NO)- ZDOT(3,1))/00013630
     1/(GMU(NO)-1. )                                                             00013640
      E4= ( GMU(N1)**3-1. )/(GMU(N1)-1.)  - ( GMU(N2)**3- 1.)/( GMU(N2) 00013650
     1-1. )                                                                      00013660
      E5=  ( GMU(N1)**3 -1.)/(GMU(N1)-1.)  - (GMU(NO)**3- 1. ) /(GMU(NO)00013670
     1 -1. )                                                                     00013680
      A2=(ZDO2(3,N1)-ZDO2(3,1))/(GMU(N1)-1.)- (ZDO2(3,N2)- ZDO2(3,1))/( 00013690
     1GMU(N2)-1.)                                                                00013700
      A3= (ZDO2(3,N1)-ZDO2(3,1))/(GMU(N1)-1. )  -(ZDO2(3,NO)- ZDO2(3,1))00013710
     1/(GMU(NO)-1. )                                                             00013720
      A4= ( GMU(N1)**3-1. )/(GMU(N1)-1.)  - ( GMU(N2)**3- 1.)/( GMU(N2) 00013730
     1-1. )                                                                      00013740
      A5=  ( GMU(N1)**3 -1.)/(GMU(N1)-1.)  - (GMU(NO)**3- 1. ) /(GMU(NO) 00013750
     1 -1. )                                                                     00013760
      DE =(E2/(GMU(N1) -GMU(N2) )        -E3/(GMU(N1) - GMU(NO) ) )/           00013770
     1  (E4/ ( GMU(N1)- GMU(N2))         -E5/ (GMU(N1)- GMU(NO) ) )             00013780
      CE = (E2 - DE*E4 )/(GMU(N1) -GMU(N2) )                                     00013790
      BE= (ZDOT(3,N1)-ZDOT(3,1))/(GMU( N1) - 1.)  -CE*(GMU(N1)**2 - 1.)/00013800
     1(GMU(N1)-1.  )   -DE*(GMU(N1)**3 - 1. )/ (GMU(N1) - 1.)                   00013810
      AE = ZDOT(3,1) -BE -CF  -DE                                                00013820
      DA =(A2/(GMU(N1) -GMU(N2) )        -A3/(GMU(N1) - GMU(NO) ) )/           00013830
     1  (A4/ ( GMU(N1)- GMU(N2))         -A5/ (GMU(N1)- GMU(NO) ) )             00013840
      CA = (A2 - DA*A4 )/(GMU(N1) -GMU(N2) )                                     00013850
      BA= (ZDO2(3,N1)-ZDO2(3,1))/(GMU( N1) - 1.)  -CA*(GMU(N1)**2 - 1.)/00013860
     1(GMU(N1)-1.  )   -DA*(GMU(N1)**3 - 1. )/ (GMU(N1) - 1.)                   00013870
      AA = ZDO2(3,1) -BA -CA  -DA                                                00013880
  320 TINT1(1) =AE/ 3. + BE/ 4.  +CF/  5.  + DE / 6.                            00013890
      TINT1(2) =  BE/ 24. + 2.*CE/ 35.  + 3.*DE / 48.                            00013900
      TINT1(3) = - BE/ (8.*24.) + DE/  (8.*20.)                                  00013910
      TINT1(4) =  BE/(16.*40.)  - DE/  (16.*120. )                               00013920
      DETINT(1) = AA/3. + BA/ 4.  + CA/5.  + DA/6.                               00013930
      DETINT(2) = BA/24. + 2.*CA/35.  + 3.*DA/48.                                00013940
      DETINT(3) = - BA/(8.*24.) + DA/(8.*20.)                                    00013950
      DETINT(4) = BA/(16.*40.)  -  DA/(16.*120.)                                 00013960
      IF (NOT .EQ. 1 ) GO TO 350                                                 00013970
      LET = NOT - 1                                                              00013980
      DO 50 I= 1,LET                                                             00013990
      PM2(I) = 0.0                                                               00014000
      DO 45  M=1,4                                                               00014010
      CON2(M) = R/A*VEL* ( P(M,I) + ( RA(I)/A)**2/GMU(I) * PP(M,I)  )            00014020
      CON3(M) = A*P(M,I)                                                         00014030
   45 PM2(I)  = PM2(I) +  RH * FUN(M)* (CON2(M)*TINT1(M) + CON3(M)               00014050
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```
     1*DFTINT(M) )                                                                  00014060
  50 CONTINUE                                                                       00014070
 350 CONTINUE                                                                       00014080
      ALF= 0.                                                                       00014090
      AL2 = 0.                                                                      00014100
      AL3 =    0.                                                                   00014110
      AL4 =    1.                                                                   00014120
      CON2I(1 ) =  R*VEL/A/DEL*(A*ARSIN(Z)*(35./64.*ALF     +5./8.*AL2            00014130
     1  +3./4.*AL3  +AL4) - R1*Z*(ALF/8. *(  -6.*Z**6  +7./3.*Z**4               00014140
     2  +35./12.*Z**2 + 35./8.)        +AL2/6.*(  -4.*Z**4  +                     00014150
     3   5./2.*Z**2 + 15./4.)   +AL3/4.*(  -2.*Z**2  +3.)))                      00014160
      CON3I(1) = A**2*ARSIN(Z)/2./DEL*(35./64.*ALF  +5./8.*AL2                  00014170
     1  + 3./4.*AL3  + AL4)    -A*Z*R1/2.*(ALF/4.*(Z**6  +7./6.*Z**4             00014180
     2   + 35./24.*Z**2  +35./16. )   +AL2/3.*(Z**4  +5./4.*Z**2                00014190
     3  +15./ 8.)  + AL3/2.*(    Z**2  + 3./2.) + AL4 ) /DEL                    00014200
      ALF = 0.                                                                  00014210
      AL2 = 0.                                                                  00014220
      AL3 =        5./2.                                                        00014230
      AL4 =           - 3./2.                                                   00014240
      CON2I( 2) =  R*VEL/A/DEL*(A*ARSIN(Z)*(35./64.*ALF     +5./8.*AL2          00014250
     1  +3./4.*AL3  +AL4) - R1*Z*(ALF/8. *(  -6.*Z**6  +7./3.*Z**4               00014260
     2  +35./12.*Z**2 + 35./8.)        +AL2/6.*(  -4.*Z**4  +                     00014270
     3   5./2.*Z**2 + 15./4.)   +AL3/4.*(  -2.*Z**2  +3.)))                      00014280
      CON3I(2) = A**2*ARSIN(Z)/2./DEL*(35./64.*ALF  +5./8.*AL2                  00014290
     1  + 3./4.*AL3  + AL4)    -A*Z*R1/2.*(ALF/4.*(Z**6  +7./6.*Z**4             00014300
     2   + 35./24.*Z**2  +35./16. )   +AL2/3.*(Z**4  +5./4.*Z**2                00014310
     3  +15./ 8.)  + AL3/2.*(    Z**2  + 3./2.) + AL4 ) /DEL                    00014320
      ALF = 0.                                                                  00014330
      AL2 =    63./8.                                                           00014340
      AL3 =       -70./ 8.                                                      00014350
      AL4 =       15./8.                                                        00014360
      CON2I( 3) =  R*VEL/A/DEL*(A*ARSIN(Z)*(35./64.*ALF     +5./8.*AL2          00014370
     1  +3./4.*AL3  +AL4) - R1*Z*(ALF/8. *(  -6.*Z**6  +7./3.*Z**4               00014380
     2  +35./12.*Z**2 + 35./8.)        +AL2/6.*(  -4.*Z**4  +                     00014390
     3   5./2.*Z**2 + 15./4.)   +AL3/4.*(  -2.*Z**2  +3.)))                      00014400
      CON3I(3) = A**2*ARSIN(Z)/2./DEL*(35./64.*ALF  +5./8.*AL2                  00014410
     1  + 3./4.*AL3  + AL4)    -A*Z*R1/2.*(ALF/4.*(Z**6  +7./6.*Z**4             00014420
     2   + 35./24.*Z**2  +35./16. )   +AL2/3.*(Z**4  +5./4.*Z**2                00014430
     3  +15./ 8.)  + AL3/2.*(    Z**2  + 3./2.) + AL4 ) /DEL                    00014440
      ALF    = 429./16.                                                         00014450
      AL2 =  -693./16.                                                          00014460
      AL3 =       315./16.                                                      00014470
      AL4 =       -35./16.                                                      00014480
```

```
      CON2I(4 ) =  R*VEL/A/DEL*(A*ARSIN(Z)*(35./64.*ALF     +5./8.*AL2   00014490
     1  +3./4.*AL3  +AL4) - R1*Z*(ALF/8. *(  -6.*Z**6  +7./3.*Z**4      00014500
     2  +35./12.*Z**2 + 35./8.)        +AL2/6.*(  -4.*Z**4  +            00014510
     3   5./2.*Z**2 + 15./4.)   +AL3/4.*(  -2.*Z**2  +3.)))              00014520
      CON3I(4) = A**2*ARSIN(Z)/2./DEL*(35./64.*ALF  +5./8.*AL2          00014530
     1  + 3./4.*AL3  + AL4)    -A*Z*R1/2.*(ALF/4.*(Z**6  +7./6.*Z**4     00014540
     2   + 35./24.*Z**2  +35./16. )   +AL2/3.*(Z**4  +5./4.*Z**2        00014550
     3  +15./ 8.)  + AL3/2.*(    Z**2  + 3./2.) + AL4 ) /DEL            00014560
      PM2(NOT) = 0.0                                                    00014570
      DO   115  M=1,4                                                   00014580
  115 PM2(NOT)=  RH*FUN(M)*(CON2I(M)*  TINT1(M)                         00014590
     I   + CON3I(M) * DETINT(M))      +  PM2(NOT)                       00014600
      IF(IND.EQ.0) GO TO 230                                            00014610
      WRITE (6,220)                                                     00014620
  220 FORMAT (1H1 8H EL PRES 10X, 10HAV EL PRES  7X, 8HTOT PRES  9X,    00014630
     1 10HSHELL VEL  //)                                                00014640
  230 WRITE (6,240) ZDOT(3,1) , PM2(1)                                  00014650
  240 FORMAT (1H+ 52X, E12.5 / 1X, E12.5)                               00014660
      IF(IND.NE.0) GO TO 180                                            00014670
      DO 160 I= 1,NOT                                                   00014680
      PM2(I) = ( FLOAT(IV)*PE2(I) + PM2(I)) / FLOAT(IV + 1)             00014690
  160 PE2(I) = PM2(I)                                                   00014700
      GO TO 200                                                         00014710
  180 DO 190 I=1,NOT                                                    00014720
  190 PE2(I) = PM2(I)                                                   00014730
  200 DO 210  I= 1,NOT                                                  00014740
  210 PM(I) = PM2(I) + PM1(I)                                           00014750
      WRITE  (6,61) PM2(1), PM(1)                                       00014760
   61 FORMAT (1H+ 18X, E12.5,3X, E12.5)                                 00014770
      RETURN                                                            00014780
      END                                                               00014790
```

```
$ORIGIN      CHAIN                                                          00014800
$IBFTC 157DR1                                                               00014810
C     6J-157DR                                  COMPUTES DEFLECTIONS        00014820
C                                                                           00014830
      SUBROUTINE  DEFLTN                                                    00014840
C                                                                           00014850
      DIMENSION   R(200), D(200), EK(200), ENI(200), EMT(200), PFE(200),    00014860
     1  PTH(200), PN(200), WFE(200), ALF(200), DNA(200), WTHD(200),         00014870
     2  RHOX(200), GAMA(200), EI(200), T(200), P(4,4,200), EM1(4,4),        00014880
     3  EM3(4,4), EM5(4), EM1N(4,4), EM3N(4,4), EM5N(4)                     00014890
C                                                                           00014900
      REAL        MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,    00014910
     1            MO                                                      00014920
C                                                                           00014930
      EQUIVALENCE      (DA(1),  EN   ),(DA(2),  AV   ),(DA(3),  HO   ),   00014940
     1(DA(4),   EO   ),(DA(5),  SIGO ),(DA(6),  ENFO ),(DA(7),  ENFL ),   00014950
     2(DA(8),  POI   ),(DA(9),  THETA),(DA(10), PIXI ),(DA(11), SPRL ),   00014960
     3(DA(12),  UK   ),(DA(13),  VK  ),(DA(14),  WK  ),(DA(15),  EMK ),   00014970
     4(DA(16),  TAU1 ),(DA(17),  ENI1),(DA(18),  PI1 ),(DA(19),  TAU2 ),   00014980
     5(DA(20),  ENT2 ),(DA(21),  PI2 ),(DA(22),  TAU3 ),(DA(23),  ENT3 ),   00014990
     6(DA(24),  PI3 ),(DA(25),  MASS ),(DA(26),  CFE ),(DA(27),  CZ  ),    00015000
     7(DA(28),  SKFE ),(DA(29),  SKZ ),(DA(30),  SUM  ),(DA(31),  EN1 ),   00015010
     8(DA(32),DEL),(DA(35),IND),(DA(36),RESTRI)                             00015020
      EQUIVALENCE      (DA(40),  R    ),(DA(240), WTHD ),(DA(440), WFE ),   00015030
     1(DA(640), GAMA ),(DA(840), RHOX),(DA(1040), D   ),(DA(1240), EK ),   00015040
     2(DA(1440),  E1 ),(DA(1640), ALF),(DA(1840), DNA ),(DA(2040),  T ),   00015050
     3(DA(2240), ENT ),(DA(2440), EMI),(DA(2640),  PN ),(DA(2840), PFE),   00015060
     4(DA(3040), PTH ),(DA(3240), DZ ),(DA(3440), VZO ),(DA(3640), AZO),   00015070
     5(DA(3840), DFO ),(DA(4040), VEO),(DA(4240), AFO ),(DA(4440), EM1),   00015080
     6(DA(4456), EM3 ),(DA(4472), EM5),(DA(4476), EM1N),(DA(4492),EM3N),   00015090
     7(DA(4508), EM5N)                                                      00015100
C                                                                           00015110
      COMMON   DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, ELAM2,         00015120
     1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),       00015130
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,         00015140
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                             00015150
     4  S77, S78, BTA11, BTA33, MC(200), OMG2(200), ZP(3,200),             00015160
     5  Z2P(3,200), Z3P(3,200), TIME, TDEL, PRNT, ENF, PRI, JT, NJT, VI    00015170
     6  ,XX(2800),INDER                                                    00015180
C                                                                           00015190
C                                                                           00015200
      N2  =  SPRL                                                           00015210
      DO   300   I = 1,N                                                    00015220
```

```
      WTH  =  WTHD(I)                                                    00015220
      GAM  =  GAMA(I)                                                    00015240
      RHO  =  RHOX(I)                                                    00015250
      S4   =  ELAM2 * FK(I) * S1                                         00015260
      S6   =  3. * WFF(I) - WTH                                          00015270
      S7   =  3. * WTH - WFF(I)                                          00015280
      S80  =  -4. * OMG2(I)                                              00015290
      S79  =  -5. * OMG2(I)                                              00015300
      LM11 =  S79  +  6. * BTA11                                         00015310
      LM22 =  S79                                                        00015320
      LM33 =  S79  +  6. * BTA33                                         00015330
      MM11 =  -(S80  +  3. * BTA11)                                      00015340
      MM22 =  - S80                                                      00015350
      MM33 =  -(S80  +  3. * BTA33)                                      00015360
      NM11 =  -OMG2(I)  +  .66666667 * BTA11                             00015370
      NM22 =  -OMG2(I)                                                   00015380
      NM33 =  -OMG2(I)  +  .66666667 * BTA33                             00015390
      IF(I - 1)100, 2,100                                                00015400
    2 IF(ENI .GE. 2.)  GO TO 95                                          00015410
C                                                  I = 1, OPEN APEX      00015420
      BP   =  (-D(3) + 4.*D(2) - 3.*D) /DEL2                             00015430
      WFFP =  (-WFF(3) + 4.*WFF(2) - 3.* WFF) /DEL2                      00015440
      TTP  =  (-ENT(3) + 4.*ENT(2) - 3.*ENT) /DEL2                       00015450
      DP   =  (-EK(3) + 4.*EK(2) - 3.*EK) /DEL2                          00015460
      EMTP =  (-EMT(3) + 4.*EMT(2) - 3.*EMT) /DEL2                       00015470
      IBCX =  0                                                          00015480
      IF(EM1 .NE. 1.E+10) GO TO 20                                       00015490
      IBCX =  FM1(2,1)                                                   00015500
      IBM  =  4439                                                       00015510
C                                                  OPEN TOP OR BOTTOM BOUND 00015520
   20 S9   =  ENF /RHO                                                   00015530
      S3   =  GAM * D(I)                                                 00015540
      S5   =  D(I) /2. * S9                                              00015550
      S8   =  S4 * S9 /8. * S6 * S7                                      00015560
      S15  =  S4 * S9 /2.                                                00015570
      S9   =  S9 **2                                                     00015580
      S10  =  S4 *(S2 * GAM**2 * WFF(I) + S9/2. * S6)                    00015590
      S11  =  S4 * S5 /D(I)                                              00015600
      IF(IBCX .EQ. 0) GO TO 83                                           00015610
      DO  22     K = 1,32                                                00015620
      IX  =  IBM + K                                                     00015630
   22 DA(IX)  =  0.                                                      00015640
      GO  TO (31, 32, 33, 34, 35), IBCX                                  00015650
```

```
C                                                    FREE  BOUNDARY
   31 DA(IBM+1) =  1.                                                    00015670
      DA(IBM+6) =  1.                                                    00015680
      DA(IBM+11)=  1.                                                    00015690
      DA(IBM+32)=  1.                                                    00015700
      GO  TO  83                                                         00015710
C                                                    ROLLER  BOUNDARY
   32 DA(IBM+1) =  1.                                                    00015730
      DA(IBM+22)=  1.                                                    00015740
      DA(IBM+27)=  1.                                                    00015750
      DA(IBM+32)=  1.                                                    00015760
      GO  TO  83                                                         00015770
C                                                    FIXED OR CLAMPED  BOUNDARY
   33 DA(IBM+16)=  1.                                                    00015790
      DA(IBM+17)=  1.                                                    00015800
      DA(IBM+22)=  1.                                                    00015810
      DA(IBM+27)=  1.                                                    00015820
      GO  TO  83                                                         00015830
C                                                    SIMPLY SUPPORTED (HINGED)
   34 DA(IBM+17)=  1.                                                    00015850
      DA(IBM+22)=  1.                                                    00015860
      DA(IBM+27)=  1.                                                    00015870
      DA(IBM+32)=  1.                                                    00015880
      GO  TO  83                                                         00015890
C                                                    COMPLETE (CLOSED)
   35 DA(IBM+11)=  1.                                                    00015910
      DA(IBM+16)=  1.                                                    00015920
      DA(IBM+17)=  1.                                                    00015930
      DA(IBM+22)=  1.                                                    00015940
C                                                                        00015950
   83 DO   84     K = 1,4                                                00015960
      EM6(K)  =  0.                                                      00015970
      DO  84     L = 1,4                                                 00015980
      EM2(K,L)  =  0.                                                    00015990
   84 EM4(K,L)  =  0.                                                    00016000
C                                                                        00016010
   85 EM2(1,1)  =  D(I) /DEL                                             00016020
      EM4(1,1)  =  POI * S3                                              00016030
      EM4(1,2)  =  POI * ENF / RHO  * D(I)                               00016040
      EM4(1,3)  =  D(I) * (WFF(I) + POI*WTH)                             00016050
      EM4(2,1)  =  -S5 * S1 - S8                                         00016060
      EM2(2,2)  =  D(I)*S1/2. + S4/8. * S7**2                            00016070
      EM4(2,2)  =  -  GAM  * EM2(2,2)                                    00016080
```

```
      EM2(2,2) = EM2(2,2) /DEL                                          00016090
      EM2(2,3) = S15 * S7                                               00016100
      EM4(2,3) = - GAM   * EM2(2,3)                                     00016120
      EM2(2,3) = EM2(2,3) /DEL                                          00016130
      EM4(3,1) = - S10                                                  00016140
      EM2(3,2) = S11 * S7 /DEL                                          00016150
      EM4(3,2) = -S11 * GAM *(S7 + 2.*S2*WTH)                           00016160
      EM2(3,3) = S4 * (2.*S9 + S2 * GAM **2) /DEL                       00016170
      EM4(3,3) = -S4 *(3. + POI) *  GAM * S9                            00016180
      EM2(3,4) = ELAM2 /DEL                                             00016190
      EM4(3,4) = ELAM2 * S1 * GAM                                       00016200
      EM2(4,3) = - 1. /DEL                                              00016210
      EM4(4,1) = WFE(I)                                                 00016220
      EM6(1) = - ENT(I)                                                 00016230
      EM6(3) = ELAM2 *  GAM   * S1 * EMT(I)                             00016240
      DO  90     K = 1,4                                                00016250
      DO  90     L = 1,4                                                00016260
   90 EM2(K,L) = - EM2(K,L) /2.                                         00016270
      GO  TO  121                                                       00016280
C                                                TOP BOUNDARY, CLOSED   00016290
   95 IF(RESTRT .NE. 0.) GO TO 94                                       00016300
      IF(TIME .NE. TDEL) GO TO 97                                       00016310
      IF(INDER.EQ.0) GO TO 94                                           00016320
      IF(IND.GE.0) GO TO 97                                             00016330
   94 DO   96     K = 1,4                                               00016340
      DO   96     L = 1,4                                               00016350
      EM1(K,L) = EM2(K,L)                                               00016360
   96 EM3(K,L) = EM4(K,L)                                               00016370
      RESTRT = 0.                                                       00016380
   97 DO   98     K = 1,4                                               00016390
      G2(K) = 0.                                                        00016400
      DO   98     L = 1,4                                               00016410
      A2(K,L) = 2. * EM1(K,L)                                           00016420
      C2(K,L) = - .25 * A2(K,L)                                         00016430
   98 EM1(K,L) = 1.5 * EM1(K,L)                                         00016440
      CALL MSU  (4,4, EM3,EM1,B2)                                       00016450
      GO TO   300                                                       00016460
  100 IF(I - N) 102,101,102                                             00016470
  101 DP  = (D(N-2) - 4.*D(N-1) + 3.*D(N)) /DEL2                        00016480
      WFEP = (WFE(N-2) - 4.*WFE(N-1) + 3.*WFE(N)) /DEL2                 00016490
      DP  = (EK(N-2) - 4.*EK(N-1) + 3.*EK(N)) /DEL2                     00016500
      TTP = (ENT(N-2) - 4.*ENT(N-1) + 3.*ENT(N)) /DEL2                  00016510
      EMTP = (EMT(N-2) - 4.*EMT(N-1) + 3.*EMT(N)) /DEL2                 00016520
```

```
      IRCX = 0                                                          00016530
      IF(FMIN .NE. 1.E+10) GO TO 20                                     00016540
      IRCX = FMIN(2,1)                                                  00016550
      IRM = 4475                                                        00016560
      GO TO 20                                                          00016570
C                                                                       00016580
  102 BP = (D(I+1) - D(I-1)) /DEL2                                      00016590
      WFEP = (WFE(I+1) - WFE(I-1)) /DEL2                                00016600
      DP = (FK(I+1) - FK(I-1)) /DEL2                                    00016610
      TTP = (ENT(I+1) - ENT(I-1)) /DEL2                                 00016620
      FMTP = (FMT(I+1) - FMT(I-1)) /DEL2                                00016630
C                                          ALL EXCEPT CLOSED APEX       00016640
  120 S3 = GAM * D(I)                                                   00016650
      S5 = D(I) /2. * ENF /RHO                                          00016660
      S8 = S4 * ENF /8. /RHO * S6 * S7                                  00016670
      S9 = (ENF /RHO) **2                                               00016680
      S10 = S4 * (S2 * GAM**2 * WFE(I) + S9/2. * S6)                    00016690
      S11 = S4 * S5 /D(I)                                               00016700
C                                                                       00016710
  121 DO 125 K = 1,4                                                    00016720
      DO 125 L = 1,4                                                    00016730
  125 E(K,L) = 0.                                                       00016740
      E(1,1) = D(I) /DEL                                                00016750
      F(1,1) = S3 + BP                                                  00016760
      S12 = WTH * WFE(I)                                                00016770
      GAM2 = GAM **2                                                    00016780
      GA(1,1) = POI * BP * GAM - D(I)*(POI*S12 + GAM2 + S1*S9 /2.)      00016790
     1 - S4 *(S2*GAM2*WFE(I)**2 + S6**2 *S9 /8.)                        00016800
      F(1,2) = S2 * S5 + S8                                             00016810
      GA(1,2) = POI*ENF/ RHO * BP - (3. - POI)*S5*GAM - S11*2.          00016820
     1 * GAM *(S6*S7/8. + S2*S12)                                       00016830
      F(1,3) = D(I)*(WFL(I) + POI*WTH) + S10                            00016840
      GA(1,3) = D(I)*(WFEP + GAM *(WFE(I)-WTH)) + BP*(WFE(I) + POI*     00016850
     1 WTH) - S4*S9 * GAM *(S6/2. + S2*WFE(I))                          00016860
      F(1,4) = FLAM2 * WFF(I)                                           00016870
      GA(1,4) = F(1,4) * S1 * GAM                                       00016880
      F(2,1) = - F(1,2)                                                 00016890
      GA(2,1) = -S5*GAM *(3.-POI) - D1*FNF/2. * BP /RHO + S11 * 2.      00016900
     1 *( -S2 * GAM *S12 + GAM /8. *(6.*S12 - 7.*WFE(I)**2 - 3.*WTH     00016910
     2 **2) - WFEP/4. *(5.*WTH - 3.*WFE(I)) ) - S11*DP/FK(I)/4.*S6*S7   00016920
      E(2,2) = (D(I)/2.*S1 + S4/8. * S7**2) /DEL                        00016930
      F(2,2) = S1/2. *( GAM * D(I) + BP) - S4/8.*S7 *(2.*WFEP - GAM     00016940
     1 *(5.*WFE(I) - 3.*WTH)) + ELAM2/8.*DP*S1 *S7**2                   00016950
```

```
      GA(2,2)  =  - GAM * F(2,2) + D(I) *(S1/2.*S12 - S7) - S4 *(S2*S5  00016960
     1 *WTH**2 - S12/8. * S7**2)                                        00016970
      E(2,3)  =  S11 * S7 /DEL                                          00016980
      F(2,3)  =  S11 *(2.*S2* GAM  *WTH - WFEP + 3.* GAM  *(WFE(I) -    00016990
     1 WTH)) + S11/EK(I)*DP * S7                                        00017000
      GA(2,3)  =  - S5*2. *(WTH + POI*WFE(I)) + S4*S5 /D(I) *(GAM *     00017010
     1 WFEP - 2.*GAM2*WFE(I) - 2.*S2*S9*WTH + S7 *(GAM2 + S12)) - S11/  00017020
     2 EK(I)*DP *  GAM  * S7                                            00017030
      GA(2,4)  =  -POI * ELAM2 * WTH * ENF /RHO                         00017040
      F(2,4)  =  0.                                                     00017050
      F(3,1)  =  - F(1,3)                                               00017060
      S13  =  WTH + POI*WFE(I)                                          00017070
      GA(3,1)  =  -D(I)* GAM * S13 + ELAM2*EK(I)*S1 *( GAM * S2 *(GAM2  00017080
     1 *WFE(I) - GAM  * WFEP - WFE(I) *(S9 - 2.*S12)) + S9/2. *(GAM     00017090
     2 *(WFE(I) - WTH) - 3.*WFEP)) - ELAM2*DP*S1 *(S2*GAM2*WFE(I) + S9  00017100
     3 /2. * S6)                                                        00017120
      E(3,2)  =  F(2,3)                                                 00017130
      F(3,2)  =  S11 *( GAM  *( WFE(I)*3. -WTH*(5. + 2.*POI)) - WFEP)   00017140
     1 + S11*DP/EK(I) * S7                                              00017150
      GA(3,2)  =  -D(I)*ENF /RHO * S13 + S11 *(2.*S2 *(S12*WTH - GAM2 * 00017160
     1 (WFE(I) - 2.*WTH) - S9*WTH) + GAM * WFEP + 3.*GAM2*(WTH - WFE(I))00017170
     2 ) + S12*S7) - S11*DP/EK(I) *( GAM  *(2.*S2*WTH + S7) )           00017180
      E(3,3)  =  S4 *(2.*S9 + S2*GAM2) /DEL                             00017190
      F(3,3)  = -S4*(S2*GAM *(2.*S12 + GAM2) + 2.*GAM * S9) + ELAM2     00017200
     1 *DP*S1 *(S2*GAM2 + 2.*S9)                                        00017210
      GA(3,3)  =  -D(I) *(WFE(I)**2 + 2.*POI*S12+WTH**2)+S4*S9*(S2*(S12-00017220
     1 S9 + 2.*GAM2) + 2.*(GAM2 + S12)) - S1*S9*DP*ELAM2 *(3.+POI)*GAM  00017230
      E(3,4)  =  ELAM2 /DEL                                             00017240
      F(3,4)  =  ELAM2 * GAM *(2. - POI)                                00017250
      GA(3,4)  =  - ELAM2 * (S1*S12 + POI*S9)                           00017260
      F(4,1)  =  EK(I) * WFE(I)                                         00017270
      GA(4,1)  =  EK(I) *(WFEP + POI*GAM*WFE(I))                        00017280
      GA(4,2)  =  EK(I) * POI*ENF*WTH /RHO                              00017290
      E(4,3)  =  -EK(I) /DEL                                            00017300
      F(4,2)  =  0.                                                     00017310
      F(4,3)  =  -EK(I) * POI * GAM                                     00017320
      F(4,4)  =  0.                                                     00017330
      GA(4,3)  =  EK(I) * POI * S9                                      00017340
  140 GA(1,1)  =  GA(1,1) - S77 * SKEE                                  00017350
      GA(3,3)  =  GA(3,3) - S77 * SKZ                                   00017360
      IF(I .NE. N2) GO TO 142                                           00017370
      S3  =  A0 /E0 * A0 /H0                                            00017380
      GA(1,1)  =  GA(1,1) - UK * S3                                     00017390
```

```
      GA(2,2) = GA(2,2) - VK * S3                                          00017410
      GA(3,3) = GA(3,3) - WK * S3                                          00017420
      S3 = S3 /AO * EMK * WFE(I)                                           00017426
      F(1,3) = F(1,3) - S3                                                 00017430
      GA(1,1) = GA(1,1) + S3 * WFF(I)                                      00017440
  142 GA(4,4) = - 1.                                                       00017450
      G (1) = (-PFE(I) + TTP - ELAM2 *S1*GAM*WFE(I)*ENT(I)) * DEL2         00017460
      G (2) = (-PTH(I) - ENF/RHO*(ENT(I)+ FLAM2*S1*WTH*EMI(I) ))*DEL2      00017470
      G (3) = (-PN(I) - (WFF(I) + WTH)*ENT(I) - FLAM2*S1 *(GAM*EMTP        00017480
     1 - EMT(I) * (S12 - S9) )) * DEL2                                     00017490
      G (4) = EMT(I) * DEL2                                                00017500
      DO 150 K = 1,4                                                       00017510
      DO 150 L = 1,4                                                       00017520
  150 E(K,L) = 2. * E(K,L)                                                 00017530
      CALL MAD (4,4, E,E,A)                                                00017540
      CALL MSU (4,4, E,F,C)                                                00017550
      DO 160 K = 1,4                                                       00017560
      DO 160 L = 1,4                                                       00017570
      E(K,L) = - 2. * E(K,L)                                               00017580
  160 GA(K,L) = DEL2 * GA(K,L)                                             00017590
      CALL MAD (4,4, E,GA,B)                                               00017600
      DO 162 K = 1,4                                                       00017610
      G(K) = G(K) * TDEL                                                   00017620
      DO 162 L = 1,4                                                       00017630
      A(K,L) = A(K,L) * TDEL                                               00017640
      B(K,L) = B(K,L) * TDEL                                               00017650
  162 C(K,L) = C(K,L) * TDEL                                               00017660
      IF(JT - 2) 163,164,165                                               00017670
  163 S79 = -6. * OMG2(I)                                                  00017680
      S80 = 6.                                                             00017690
      GO TO 166                                                            00017700
  164 LM11 = S80 + 5.3333333 * BTA11                                       00017710
      LM22 = S80                                                           00017720
      LM33 = S80 + 5.3333333 * BTA33                                       00017730
  165 S79 = -2. * OMG2(I)                                                  00017740
      S80 = 11. /3.                                                        00017750
  166 B(1,1) = B(1,1) + S79 + S80 * BTA11                                  00017760
      B(2,2) = B(2,2) + S79                                                00017770
      B(3,3) = B(3,3) + S79 + S80 * BTA33                                  00017780
      G(1) = G(1) + LM11*ZP(1,I) + NM11*Z2P(1,I) + NM11*Z3P(1,I)           00017790
      G(2) = G(2) + LM22*ZP(2,I) + NM22*Z2P(2,I) + NM22*Z3P(2,I)           00017800
      G(3) = G(3) + LM33*ZP(3,I) + NM33*Z2P(3,I) + NM33*Z3P(3,I)           00017810
      IF(I - 2) 210,170,169                                                00017820
```

```
  169 IF(I - N) 185,200,185                                              00017830
C                                                        I = 2          00017840
  170 CALL INV  (4, C, PI, IERR)                                         00017850
      CALL MMY  (4,4,4, B2,C,EM4)                                        00017860
      CALL MMY  (4,4,4, EM4,B,B2)                                        00017870
      CALL MSU  (4,4,  B2,A2,B2)                                         00017880
      CALL INV  (4, B2, PI, IERR)                                        00017890
      IF(EN1 - 2.) 176,172,172                                           00017900
  172 CALL MMY  (4,4,4, EM4,A,A2)                                        00017910
      CALL MSU  (4,4,  A2,C2,A2)                                         00017920
      CALL MMY  (4,4,4, B2,A2,P(1,1,2))                                  00017930
      GO TO 178                                                          00017940
  176 CALL MMY  (4,4,4, B2,EM4,A2)                                       00017950
      CALL MMY  (4,4,4, A2,A,P(1,1,2))                                   00017960
  178 CALL MMY  (4,4,1, EM4,G,EM6)                                       00017970
      CALL MSU  (4,1,  EM6,G2,G2)                                        00017980
      CALL MMY  (4,4,1, B2,G2,X(1,2))                                    00017990
C                          I = 2 **PRESERVE  A, B, C, G MATRIC         00018000
      DO 180    K = 1,4                                                  00018010
      G2(K) = G(K)                                                       00018020
      DO 180    L = 1,4                                                  00018030
      A2(K,L) = A(K,L)                                                   00018040
      B2(K,L) = B(K,L)                                                   00018050
  180 C2(K,L) = C(K,L)                                                   00018060
      GO TO   300                                                        00018070
  185 CALL MMY  (4,4,4, C,P(1,1,I-1),EM4)                                00018080
      CALL MSU  (4,4,  B,EM4,EM4)                                        00018090
      CALL INV  (4, EM4, PI, IERR)                                       00018100
      CALL MMY  (4,4,1, C,X(1,I-1),EM6)                                  00018110
      CALL MSU  (4,1,  G,EM6,EM6)                                        00018120
      IF(I - N) 190,220,190                                              00018130
  190 CALL MMY  (4,4,4, EM4,A,P(1,1,I))                                  00018140
      CALL MMY  (4,4,1, EM4,EM6,X(1,I))                                  00018150
      GO TO   300                                                        00018160
C                                                        I = N          00018170
  200 CALL INV  (4, A, PI, IERR)                                         00018180
      CALL MMY  (4,4,4, EM1N,EM2,GA)                                     00018190
      CALL MMY  (4,4,4, GA,A,EM2)                                        00018200
      CALL MMY  (4,4,4, EM1N,EM4,A)                                      00018210
      CALL MAD  (4,4, EM3N,A,A)                                          00018220
      CALL MMY  (4,4,4, EM2,B,E)                                         00018230
      CALL MAD  (4,4, A,E,B)                                             00018240
      CALL MMY  (4,4,4, EM2,C,E)                                         00018250
```

```
      CALL MAD  (4,4, GA,E,C)                                          00018260
      CALL MMY  (4,4,1, EM1N,F46,EC)                                   00018270
      CALL MSU  (4,1, FM5N,EC,EC)                                      00018280
      CALL MMY  (4,4,1, EM2,G,E)                                       00018290
      CALL MAD  (4,1, EC,E,G)                                          00018300
      DO   205   K = 1,4                                               00018310
      DO   205   L = 1,4                                               00018320
      GA(K,L)  =  0.                                                   00018330
  205 E(K,L)   =  0.                                                   00018340
      GO  TO  185                                                      00018350
C                                                  I = 1, OPEN APEX    00018360
  210 CALL INV  (4, C, PI, IERR)                                       00018370
      CALL MMY  (4,4,4, EM1,EM2,GA)                                    00018380
      CALL MMY  (4,4,4, GA,C,EM2)                                      00018390
      CALL MMY  (4,4,4, EM1,EM4,C)                                     00018400
      CALL MAD  (4,4, EM3,C,C)                                         00018410
      CALL MMY  (4,4,4, EM2,B,E)                                       00018420
      CALL MSU  (4,4,  C,E,B2)                                         00018430
      CALL MMY  (4,4,4, EM2,A,E)                                       00018440
      CALL MAD  (4,4,  GA,E,A)                                         00018450
      DO   215   K = 1,4                                               00018460
      DO   215   L = 1,4                                               00018470
  215 A2(K,L)= -A(K,L)                                                 00018480
      CALL MMY  (4,4,1, EM1,EM6,EC)                                    00018490
      CALL MSU  (4,1,  EM5,EC,EC)                                      00018500
      CALL MMY  (4,4,1, EM2,G,F)                                       00018510
      CALL MSU  (4,1,  EC,E,G2)                                        00018520
      DO   217   K = 1,4                                               00018530
      DO   217   L = 1,4                                               00018540
      GA(K,L)  =  0.                                                   00018550
  217 E(K,L)   =  0.                                                   00018560
      GO  TO  300                                                      00018570
  220 CALL MMY  (4,4,1, EM4,EM6,Z(1,N1))                               00018580
  300 CONTINUE                                                         00018590
C                                                  DEFLECTIONS       00018600
      DO   305   I = 1,N                                               00018610
      IZ  =  N - I                                                     00018620
      IF(IZ - 1) 304,310,304                                           00018630
  304 CALL MMY  (4,4,1, P(1,1,IZ),Z(1,IZ+1),EM6)                       00018640
  305 CALL MSU  (4,1,  X(1,IZ),EM6,Z(1,IZ))                            00018650
C                                                  I = 1             00018660
  310 CALL MMY  (4,4,1, B2,Z(1,2),EM6)                                 00018670
      CALL MSU  (4,1,  G2,EM6,G2)                                      00018680
```

```
      CALL MMY   (4,4,1, A2,Z(1,3),EM6)                          00018690
      CALL MSU   (4,1,  G2,EM6,G2)                               00018700
      CALL MMY   (4,4,1, C2,G2,Z(1,1))                           00018710
C                                                                00018720
 1000 RETURN                                                     00018730
      END                                                        00018740
```

```
$IBFTC MSUB                                                          00018750
C       MATRIX SUBTRACT SUBROUTINE                DECK NO. 8K-904    00018760
C                                                                    00018770
C  ARGUMENTS                                                         00018780
C       L  NO. OF ROWS                                               00018790
C       M  NO. OF COLS                                               00018800
C       A(I,J)   MRA                                                 00018810
C       B(I,J)   MSU                                                 00018820
C       C(I,J)   MSR                                                 00018830
        SUBROUTINE MSU(L,M,A,B,C)                                    00018840
        DIMENSION   A(4,4), B(4,4), C(4,4)                           00018850
        DO 30 I=1,L                                                  00018860
        DO 30 J=1,M                                                  00018870
   30   C(I,J)=A(I,J)-B(I,J)                                         00018880
        RETURN                                                       00018890
        END                                                          00018900
```

```
$IBFTC INVRS                                                                    00018910
C       MATRIX INVERSION SUBROUTINE                          DECK NO. 8K-900    00018920
C                                                                               00018930
C            MODIFICATION OF F1,4B444 BY D.J.HALLMAN,DEPT. 56,LA                00018940
C                                                                               00018950
C  ARGUMENTS                                                                    00018960
C       IOM     INDICATOR OF ORDER (N) OF MATRIX A   COMPILED FOR 4 X 4         00018970
C       IERROR  INDICATOR OF ERROR RETURN        =1,NORMAL.   NOT=1,ERR         00018980
C                                                                               00018990
C  MATRICES                                                                     00019000
C       A(I,J)  INPUT MATRIX                          N,N          I,J          00019010
C       LR(M)   MATRIX OF LOCATIONS OF MAX ROW        M,1                       00019020
C       LC(M)   MATRIX OF LOCATIONS OF MAX COL        1,M                       00019030
C                                                                               00019040
C  SUBSCRIPTS                                                                   00019050
C       I       ROW OF A                                                        00019060
C       J       COL OF A                                                        00019070
C       MI      LOCATION OF PIVOT BEFORE INTERCHANGE,ROW OF MAX                 00019080
C       MJ      LOCATION OF PIVOT BEFORE INTERCHANGE,COL OF MAX                 00019090
C       M       LOCATION OF PIVOT,ROW AND COL                                   00019100
C       N       ORDER OF MATRIX                                                 00019110
C                                                                               00019120
C  VARIABLES                                                                    00019130
C       P       PIVOT ELEMENT,MAX ELEMENT BEFORE INTERCHANGE                    00019140
C       PI      PI PRODUCT OF P(M) =VALUE OF DETERMINANT                        00019150
C                                                                               00019160
C  TEMPORARY                                                                    00019170
C       TEMP    INTERCHANGE AND REORDERING OF ELEMENTS OF A                     00019180
C                                                                               00019190
C                    *          *          *          *          *             00019200
C                                                                               00019210
      SUBROUTINE INV(IOM,A,PI,IERROR)                                           00019220
      DIMENSION   A(4,4), LR(4), LC(4)                                          00019230
C     SETUP                                                                     00019240
      M=1                                                                       00019250
      N=IOM                                                                     00019260
      PI=1.0                                                                    00019270
C     SEARCH REDUCED ARRAY FOR MAXIMUM ELEMENT                                  00019280
 1000 P=0.0                                                                     00019290
      DO 1010 I=M,N                                                             00019300
      DO 1010 J=M,N                                                             00019310
      IF( ABS(P) - ABS( A(I,J) ) ) 1005,1010,1010                               00019320
 1005 P=A(I,J)                                                                  00019330
```

```
      MI=I                                                          00019340
      MJ=J                                                          00019350
 1010 CONTINUE                                                      00019360
      LR(M)=MI                                                      00019370
      LC(M)=MJ                                                      00019380
C     INTERCHANGE MAXIMUM ROW WITH PIVOT ROW                        00019390
 2000 IF(MI-M)2100,2200,2100                                        00019400
 2100 DO 2110 J=1,N                                                 00019410
      TEMP=A(MI,J)                                                  00019420
      A(MI,J)=-A(M,J)                                               00019430
 2110 A(M,J)=TEMP                                                   00019440
C     INTERCHANGE MAXIMUM COL WITH PIVOT COL                        00019450
 2200 IF(MJ-M)2205,3000,2205                                        00019460
 2205 DO 2210 I=1,N                                                 00019470
      TEMP=A(I,MJ)                                                  00019480
      A(I,MJ)=-A(I,M)                                               00019490
 2210 A(I,M)=TEMP                                                   00019500
C     DIVIDE PIVOT COL BY PIVOT ELEMENT                             00019510
 3000 DO 3010 I=1,N                                                 00019520
      IF(I-M)3005,3010,3005                                         00019530
 3005 A(I,M)=-A(I,M)/P                                              00019540
 3010 CONTINUE                                                      00019550
C     ELIMINATE                                                     00019560
 4000 DO 4210 I=1,N                                                 00019570
      IF(I-M)4005,4210,4005                                         00019580
 4005 DO 4110 J=1,N                                                 00019590
      IF(J-M)4105,4110,4105                                         00019600
 4105 A(I,J)=A(I,M)*A(M,J)+A(I,J)                                   00019610
 4110 CONTINUE                                                      00019620
 4210 CONTINUE                                                      00019630
C     DIVIDE PIVOT ROW BY PIVOT ELEMENT                             00019640
 5000 DO 5010 J=1,N                                                 00019650
      IF(J-M)5005,5010,5005                                         00019660
 5005 A(M,J)=A(M,J)/P                                               00019670
 5010 CONTINUE                                                      00019680
      A(M,M)=1.0/P                                                  00019690
      M=M+1                                                         00019700
      IF(M-N)1000,5020,5999                                         00019710
 5020 P=A(M,M)                                                      00019720
      GO TO 3000                                                    00019730
 5999 M=N-1                                                         00019740
 6000 MI=LC(M)                                                      00019750
      MJ=LR(M)                                                      00019760
```

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C       RE-ORDER ROWS OF INVERSE                                        00019770
        IF(MI-M)6005,6200,6005                                          00019780
 6005   DO 6010 J=1,N                                                   00019790
        TEMP=A(M,J)                                                     00019800
        A(M,J)=-A(MI,J)                                                 00019810
 6010   A(MI,J)=TEMP                                                    00019820
C       RE ORDER COLS OF INVERSE                                        00019830
 6200   IF(MJ-M)6205,7000,6205                                          00019840
 6205   DO 6210 I=1,N                                                   00019850
        TEMP=A(I,M)                                                     00019860
        A(I,M)=-A(I,MJ)                                                 00019870
 6210   A(I,MJ)=TEMP                                                    00019880
 7000   M=M-1                                                           00019890
        IF(M)9002,9001,6000                                             00019900
 9001   IERROR=1                                                        00019910
        GO TO 9999                                                      00019920
C       M IS LESS THAN ZERO                                             00019930
 9002   IERROR=2                                                        00019940
 9999   RETURN                                                          00019950
        END                                                             00019960
```

```
$ORIGIN        CHAIN                                                          00019970
$IBFTC WHERE                                                                  00019980
C     6.0-157DR                                  DETERMINES PROGRAM FLOW      00019990
C                                                                             00020000
      SUBROUTINE  PATH                                                        00020010
C                                                                             00020020
      DIMENSION   ZDOT(3,200), Z2DOT(3,200), PFF(20.), PN(200)                00020030
C                                                                             00020040
      REAL        MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,       00020050
     1            MO                                                          00020060
      EQUIVALENCE       (DA(1), EN   ),(DA(2),  A0   ),(DA(3),  H0   ),00020070
     1(DA(4),   E0   ),(DA(5),  SIG0 ),(DA(6),  FNF0 ),(DA(7),  FNFL ),00020080
     2(DA(8),  POI   ),(DA(9),  THETA),(DA(10),  PIXI ),(DA(11),  SPRL ),00020090
     3(DA(12),  UK   ),(DA(13),  VK   ),(DA(14),   WK   ),(DA(15),  EMK ),00020100
     4(DA(16),  TAU1 ),(DA(17),  ENT1),(DA(18),  PI1  ),(DA(19),  TAU2 ),00020110
     5(DA(20),  ENT2 ),(DA(21),  PI2 ),(DA(22),  TAU3 ),(DA(23),  ENT3 ),00020120
     6(DA(24),  PI3  ),(DA(25),  MASS),(DA(26),  CEE  ),(DA(27),  CZ   ),00020130
     7(DA(28),  SKEE ),(DA(29),  SKZ ),(DA(30),  SUR  ),(DA(31),  EN1  ),00020140
     8(DA(32),  DEL  ),(DA(35),  IND  ),(DA(39),  DRW  )                      00020150
      EQUIVALENCE       (DA(40),  R    ),(DA(240), WTHD ),(DA(440), WFF  ),00020160
     1(DA(640), GAMA ),(DA(840), RHOX),(DA(1040),  D   ),(DA(1240), EK   ),00020170
     2(DA(1440),  E1 ),(DA(1640), ALF),(DA(1840), DNA ),(DA(2040),  T   ),00020180
     3(DA(2240), ENT ),(DA(2440), EMT),(DA(2640),  PN  ),(DA(2840), PFE),00020190
     4(DA(3040), PTH ),(DA(3240),ZDOT),(DA(3440), VZ0 ),(DA(3640), AZ0),00020200
     5(DA(3840),Z2DOT),(DA(4040), VF0),(DA(4240), AF0 ),(DA(4440), EM1),00020210
     6(DA(4456), EM3 ),(DA(4472), EM5),(DA(4476), EM1N),(DA(4492),EM3N),00020220
     7(DA(4508), EM5N)                                                        00020230
C                                                                             00020240
      COMMON    DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, ELAM2,          00020250
     1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),         00020260
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,           00020270
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                               00020280
     4  S77, S78, BTA11, BTA33, M0(200), OMG2(200), ZP(3,200),               00020290
     5  Z2P(3,200), Z3P(3,200), TIMX, TDEL, PRNT, ENF, PRI, JT, NJT          00020300
C                                                                             00020310
      IPRNT  =  PRNT                                                          00020320
      SL1  =  0.                                                              00020330
      IF(IPRNT .EQ. JT) GO TO 90                                              00020340
      IF(JT .EQ. NJT)  GO TO  90                                              00020350
      SL1  =  1.                                                              00020360
      IF(DRW .EQ. 0.)  GO TO 90                                               00020370
      SL1  =  -1.                                                             00020380
C                                          COMPUTE VELOCITIES, ACCELER.       00020390
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```
      90 S3  =  11.                                                    00020400
         S4  =  18.                                                    00020410
         S5  =   2.                                                    00020420
         S6  =   5.                                                    00020430
         S9=0.                                                         00020440
         S10=2.                                                        00020450
         S11=4.                                                        00020460
         S12=1.                                                        00020470
         IF(JT - 2) 100,110,120                                        00020480
     100 S3=6.                                                         00020490
         S4=6.                                                         00020500
         S9=0.                                                         00020510
         S10=0.                                                        00020520
         S5=0.                                                         00020530
         S6=0.                                                         00020540
         S11=0.                                                        00020550
         S12=0.                                                        00020560
         GO  TO  120                                                   00020570
     110 S3=6.                                                         00020580
         S4=6.                                                         00020590
         S9=0.                                                         00020600
         S10=0.                                                        00020610
         S5=1.                                                         00020620
         S6=2.                                                         00020630
         S11=1.                                                        00020640
         S12=0.                                                        00020650
     120 S7  =  6. * TDEL                                              00020660
         TDEL2  =  TDEL **2                                            00020670
C                                                                      00020680
         DO   150   L = 1,N                                            00020690
         DO   150   K = 1,3                                            00020700
         ZDOT(K,L)  =  (S3 * Z(K,L) - S4 * ZP(K,L) + S9 * Z2P(K,L) -   00020710
        1              S10* Z3P(K,L)) /S7                              00020720
     150 Z2DOT(K,L)  =  (S5 * Z(K,L) - S6 * ZP(K,L) + S11* Z2P(K,L) -  00020730
        1              S12* Z3P(K,L)) /TDEL2                           00020740
         IF(JT.GT.1) GO TO 170                                         00020750
         DO 160 L=1,N                                                  00020760
         Z2DOT(1,L)= ZDOT(1,L)          /TDEL                          00020770
         Z2DOT(2,L)=0.                                                 00020780
     160 Z2DOT(3,L)= ZDOT(3,L)          /TDEL                          00020790
     170 CONTINUE                                                      00020800
C                                                                      00020810
         IF(SL1 .LT. 0.)  GO TO 300                                    00020820
```

```
      IF(JT .EQ. NJT)  GO TO 200                                        00020830
      IF(IND.EQ.0) GO TO 50                                             00020840
      PRNT  =  PRNT + PRI                                               00020850
      GO  TO  50                                                        00020860
C                                          SET UP NEW INTERVAL          00020870
  200 IF(TAU1 + TAU2 - TIMX .LE. 1.E-8)  GO TO 210                      00020880
C                                                        SECOND          00020890
      TDEL  =  TAU2 /FNT2                                               00020900
      PRNT  =  PI2                                                      00020910
      NJT   =  FNT2                                                     00020920
      PRI   =  PI2                                                      00020930
      TIMX  =  TAU1                                                     00020940
      GO  TO  220                                                       00020950
C                                                        THIRD           00020960
  210 IF(TAU1 + TAU2 + TAU3 - TIMX .LE. 1.E-8)  GO TO 50                00020970
      TDEL  =  TAU3 /FNT3                                               00020980
      PRNT  =  PI3                                                      00020990
      NJT   =  FNT3                                                     00021000
      PRI   =  PI3                                                      00021010
      TIMX  =  TAU2 + TAU1                                              00021020
C                                                                       00021030
  220 JT  =  1                                                          00021040
      TDEL2  =  TDEL **2                                                00021050
      DO   250   K = 1,3                                                00021060
      DO   250   I = 1,N                                                00021070
      IF(K - 2) 231,232,233                                             00021080
  231 S8  =  PFE(I) /M0(I)                                              00021090
      GO  TO  240                                                       00021100
  232 S8  =  0.                                                         00021110
      GO  TO  240                                                       00021120
  233 S8  =  PN(I) /M0(I)                                               00021130
  240 ZP(K,I)  =  Z(K,I)                                                00021140
      Z2P(K,L)  =  S8 * TDEL2 + 2. * Z(K,L)                             00021150
  250 Z3P(K,L)  =  6. *(S8*TDEL2 + ZDOT(K,L)*TDEL) + 9.*Z(K,L)          00021160
      GO  TO  80                                                        00021170
C                                                                       00021180
  300 WRITE (6,310) ((ZDOT(K,L), K=1,3), (Z2DOT(K,L), K=1,3), L=1,N)    00021190
  310 FORMAT(///10X,28HVELOCITIES AND ACCELERATIONS // 15X,6HVEL(U),    00021200
     1  10X,6HVEL(V), 10X,6HVEL(W), 10X,6HACC(U), 10X,6HACC(V), 10X,    00021210
     2  6HACC(W) // (6X, 1P6E16.3) )                                    00021230
C                                                                       00021240
   50   CONTINUE                                                        00021250
   80 RETURN                                                            00021260
      END                                                               00021270
```

```
$ORIGIN        CHAIN                                                          00021280
$IBFTC 157DR2                                                                 00021290
C       6.0-157DR                                  COMPUTES INTERNAL LOADS    00021300
C                                                                             00021310
        SUBROUTINE  INTLDS                                                    00021320
C                                                                             00021330
        DIMENSION   R(200), D(200), EK(200), ENT(200), EMT(200), PEE(200),00021340
       1  PTH(200), PN(200), WEE(200), ALF(200), DNA(200), WTHD(200),        00021350
       2  RHOX(200), GAMA(200), E1(200), T(200), EETH(200)                   00021360
        DIMENSION  USUM(200), VSUM(200), WSUM(200), EMEE(200), EMTH(200),  00021370
       1  EMFT(200), ENFE(200), ENTH(200), ENFT(200), SIGEE(200),            00021380
       2  SIGTH(200), SIGFT(200), QEE(200), QTH(200)                         00021390
C                                                                             00021400
        REAL        MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,  00021410
       1            MO                                                       00021420
C                                                                             00021430
        EQUIVALENCE      (DA(1), EN   ),(DA(2),  AO   ),(DA(3),  HO   ),00021440
       1(DA(4),  EO   ),(DA(5),  SIGO ),(DA(6),  FNFO ),(DA(7),  FNFL ),00021450
       2(DA(8),  POI  ),(DA(9),  THETA),(DA(10), PIXI ),(DA(11), SPRL ),00021460
       3(DA(12), UK   ),(DA(13), VK   ),(DA(14), WK   ),(DA(15), FMK  ),00021470
       4(DA(16), TAU1 ),(DA(17), ENT1 ),(DA(18), PI1  ),(DA(19), TAU2 ),00021480
       5(DA(20), ENT2 ),(DA(21), PI2  ),(DA(22), TAU3 ),(DA(23), ENT3 ),00021490
       6(DA(24), PI3  ),(DA(25), MASS ),(DA(26), CFF  ),(DA(27), CZ   ),00021500
       7(DA(28), SKFE ),(DA(29), SKZ  ),(DA(30), SUM  ),(DA(31), EN1  ),00021510
       8(DA(32), DEL  )                                                   00021520
        EQUIVALENCE      (DA(40), R    ),(DA(240), WTHD ),(DA(440), WEE  ),00021530
       1(DA(640), GAMA ),(DA(840), RHOX),(DA(1040), D   ),(DA(1240), EK ),00021540
       2(DA(1440), E1  ),(DA(1640), ALF),(DA(184 ), DNA ),(DA(2040), T  ),00021550
       3(DA(2240), ENT ),(DA(2440), EMT),(DA(2640), PN  ),(DA(2840), PEE),00021560
       4(DA(3040), PTH ),(DA(3240), DZO),(DA(3440), VZO ),(DA(3640), AZO),00021570
       5(DA(3840), DFO ),(DA(4040), VFO),(DA(4240), AFO ),(DA(4440), FM1),00021580
       6(DA(4456), FM3 ),(DA(4472), EM5),(DA(4476), FM1N),(DA(4492),FM3N),00021590
       7(DA(4508), FM5N)                                                  00021600
C                                                                             00021610
        COMMON   DA(4511), FM2(4,4), FM4(4,4), FM6(4), S1, S2, FLAM2,      00021620
       1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),     00021630
       2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,       00021640
       3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                            00021650
       4  S77, S78, BTA11, BTA33, MO(200), OMG2(200), ZP(3,200),            00021660
       5  Z2P(3,200), Z3P(3,200), TIMX, TDEL, PRNT, ENF, PRI, JT, NJT, V1  00021670
        COMMON                                                             00021680
       1 USUM, VSUM, WSUM, EMEE, EMTH, EMFT, ENFE, ENTH, ENFT, SIGEE,     00021690
       2 SIGTH, SIGFT, QEE, QTH                                           00021700
```

```
C                                                                       00021710
C                          COMPUTE INTERNAL LOADS                       00021720
  490 S3   =  1. - POI **2                                              00021730
      S4   =  S1 /2.                                                    00021740
      S12  =  SIGO /E0 /S3                                              00021750
      S20  =  (H0 /A0) **2                                              00021760
      IF(EN1 - 2.) 496,497,497                                          00021770
  496 L1   =  1                                                         00021780
      GO TO  498                                                        00021790
  497 L1   =  2                                                         00021800
      WP   =  (-Z(3,3) + 4.*Z(3,2) - 3.*Z(3,1)) /DEL2                   00021810
      FETH(1)  =  ENF * WP + WTHD * Z(2,1)                              00021820
  498 DO   500   I = L1,N                                               00021830
  500 FETH(I)  =  ENF /RHOX(I) * Z(3,I) + WTHD(I) * Z(2,I)              00021840
  502 DO   1000  I = 1,N                                                00021850
      IF(I - 1)  520,504,520                                            00021860
  504 IF(EN1 - 2.) 510,506,506                                          00021870
  506 ENFEX  =  D(1) *((S2*(Z(1,2) - Z(1,1)) + ENF*POI*(Z(2,2) - Z(2,1))00021880
     1 ) /DEL + WFF * S2 * Z(3,1)) - ENT                                00021890
      S6   =  2. - ENF **2                                              00021900
      ENTHX  =  2. * FNFEX /S6                                          00021910
      ENFTX  =  ENF * FNFEX /S6                                         00021920
      FMFTX  =  ENF * Z(4,1) /S6                                        00021930
      FMTHX  =  2.0 * Z(4,1) /S6                                        00021940
      GO TO   552                                                       00021950
C                                                        I = 1          00021960
  510 ROP = (-RHOX(3) + 4. * RHOX(2) - 3. * RHOX) /DEL2                 00021970
      WP = (-Z(3,3)   + 4. * Z(3,2)  - 3. * Z(3,1)) /DEL2               00021980
      FETHP = (-FETH(3) + 4.*FETH(2) - 3. * FETH(1)) /DEL2              00021990
      VP = (-Z(2,3)   + 4. * Z(2,2)  - 3. * Z(2,1)) /DEL2               00022000
      UP = (-Z(1,3)   + 4. * Z(1,2)  - 3. * Z(1,1)) /DEL2               00022010
      FM6(4) = (-Z(4,3) + 4. * Z(4,2) - 3. * Z(4,1)) /DEL2              00022020
  515 FM6(2)  =  VP                                                     00022030
      FM6(3)  =  WP                                                     00022040
      FM6(1)  =  UP                                                     00022050
      GO TO  550                                                        00022060
  520 IF(I - N) 540,530,540                                             00022070
C                                                        I = N          00022080
  530 WP   =  (Z(3,N-2) - 4.*Z(3,N-1) + 3.*Z(3,N)) /DEL2                00022090
      FETHP  =  (FETH(N-2) - 4.*FETH(N-1) + 3.*FETH(N)) /DEL2           00022100
      VP   =  (Z(2,N-2) - 4.*Z(2,N-1) + 3.*Z(2,N)) /DEL2                00022110
      UP   =  (Z(1,N-2) - 4.*Z(1,N-1) + 3.*Z(1,N)) /DEL2                00022120
      FM6(4)  =  (Z(4,N-2) - 4.*Z(4,N-1) + 3.*Z(4,N)) /DEL2             00022130
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      ROP = (RHOX(N-2) - 4.*RHOX(N-1) + 3.*RHOX(N)) /DEL2                00022140
      GO TO 515                                                          00022150
C                                                  I NOT 1 NOR N          00022160
  540 WP  =  (Z(3,I+1) - Z(3,I-1)) /DEL2                                 00022170
      FFTHP  = (FFTH(I+1) - FFTH(I-1)) /DEL2                             00022180
      ROP  =  (RHOX(I+1) - RHOX(I-1)) /DEL2                              00022190
      VP  =  (Z(2,I+1) - Z(2,I-1)) /DEL2                                 00022200
      UP  =  (Z(1,I+1) - Z(1,I-1)) /DEL2                                 00022210
      FM6(4)  =  (Z(4,I+1) - Z(4,I-1)) /DEL2                             00022220
      GO TO 515                                                          00022230
  550 FFFE  =  - WP + WFF(I) * Z(1,I)                                    00022240
      X(3,I)  =  FFFF                                                    00022250
      S11  =  FNF /RHOX(I)                                               00022260
      S5  =  S11*Z(2,I) + GAMA(I)*Z(1,I) + WTHD(I)*Z(3,I)                00022270
      S6  =  UP + WFE(I)*Z(3,I)                                          00022280
      EKTH  =  S11 * FETH(I) + GAMA(I) * FEFF                            00022290
      ENFEX  =  D(I) *(S6 + POI*S5) - ENT(I)                             00022300
      EMTHX  =  POI*Z(4,I) + FK(I)*S3*EKTH - S1*FMT(I)                   00022310
      ENTHX  =  D(I) *(S5 + POI*S6) - FNT(I)                             00022320
      ENFTX  =  D(I)*S4 *(VP - GAMA(I)*Z(2,I) - S11*Z(1,I))              00022330
      FMFTX  =  FK(I)*S4 *(-S11*FEFE + FETHP - GAMA(I)*FETH(I) + .5 *    00022340
     1 (WTHD(I) - WFE(I)) * (S11*Z(1,I) + VP + GAMA(I)*Z(2,I)) )         00022350
  552 S15  =  DNA(I) /AU                                                 00022360
      S7  =  S15 * S3                                                    00022370
      S9  =  E1(I) * ALF(I) * T(I) /S1                                   00022380
      S8  =  S12 * E1(I)                                                 00022390
      S10  =  S8 * S15 * EMT(I) /EK(I)                                   00022400
      IF(RHOX(I)) 551,555,551                                            00022410
  551 IF(I - 1) 554,553,554                                              00022420
  553 S13  =  2.                                                         00022430
      GO TO 559                                                          00022440
  554 S13  =  1.                                                         00022450
      GO TO 559                                                          00022460
  555 S6  =  S15 /EK(1) *(Z(4,1) + EMT(1))                               00022470
      S11  =  (Z(2,2) - Z(2,1)) /DEL                                     00022480
      S13  =  (Z(1,2) - Z(1,1)) /DEL                                     00022490
      IF(ENF - 1.) 556,557,558                                           00022500
  556 G(1)  =  S8 *(S2 *(S13 + WFE * Z(3,1)) + S6) - S9                  00022510
      G(2)  =  G(1)                                                      00022520
      G(3)  =  0.                                                        00022530
      GO TO 578                                                          00022540
  557 G(1)  =  S8 *(POI * S11 + S6) - S9                                 00022550
      G(2)  =  S8 *(S11 + S6 /POI) - S9                                  00022560
```

```
      G(3) = 0.                                                          00022570
      GO TO 578                                                          00022580
  558 G(1) = S8 *(S2*S13 + POI*ENF*S11 + S6) - S9                        00022590
      G(2) = S8 *(S2*S13 + ENF*S11 + S6 /POI) - S9                       00022600
      G(3) = S8*ENF *(S15 /(2.-ENF**2) * Z(4,I) /FK(I) - S13 * S1/2.)    00022610
      GO TO 578                                                          00022620
  559 S6 = S4 * (S15/2. *(3. * WTHD(I) - WFF(I)) + 1.)                   00022630
      QFFX = S20 *(GAMA(I) *(Z(4,I) - FMTHX) + FM6(4) + ENF/PHOX(I) *    00022640
     1 EMFTX * S13)                                                      00022650
  566 DO 560 K = 1,3                                                     00022660
      DO 560 L = 1,4                                                     00022670
  560 EM4(K,L) = 0.                                                      00022680
      FM4(1,1) = S8                                                      00022690
      EM4(2,1) = POI * S8                                                00022700
      FM4(2,3) = - S7 * GAMA(I) * S8                                     00022710
      FM4(3,2) = S6 * S8                                                 00022720
      FM4(3,3) = S15 * S1 * S11 * S8                                     00022730
      G2(1) = S10 - S9                                                   00022740
      G2(2) = POI * S10 - S9                                             00022750
      G2(3) = 0.                                                         00022760
      B2(1,1) = POI * GAMA(I) * S8                                       00022770
      B2(1,2) = POI * S11 * S8                                           00022780
      B2(1,3) = (WFF(I) + POI * WTHD(I) ) * S8                           00022790
      B2(1,4) = S15 /FK(I) * S8                                          00022800
      B2(2,1) = GAMA(I) * (1. + S7*WFF(I)) * S8                          00022810
      B2(2,2) = S8 * S11 *(1. + S7*WTHD(I))                              00022820
      B2(2,3) = S8 *(WTHD(I) + POI*WFF(I) + S7 * S11 **2)                00022830
      B2(2,4) = B2(1,4) * POI                                            00022840
      B2(3,1) = S8 * S4 * S11 *(S15/2. *(WTHD(I) - 3.*WFF(I)) - 1.)      00022850
      B2(3,2) = - FM4(3,2) * GAMA(I)                                     00022860
      B2(3,3) = - S8 * S1 * S11 * S15 * GAMA(I)                          00022870
      B2(3,4) = 0.                                                       00022880
      CALL MMY (3,4,1,EM4,EM6,G)                                         00022890
      CALL MMY (3,4,1,B2,Z(1,I),EC)                                      00022900
      CALL MAD (3,1,G,EC,G)                                              00022910
      CALL MAD (3,1,G,G2,G)                                              00022920
C                                  SAVE FOURIER COEFFICIENTS             00022930
  578 USUM(I) = Z(1,I)                                                   00022940
      VSUM(I) = Z(2,I)                                                   00022950
      WSUM(I) = Z(3,I)                                                   00022960
      FMFE(I) = Z(4,I)                                                   00022970
      FMTH(I) = FMTHX                                                    00022980
      FMFT(I) = EMFTX                                                    00022990
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      ENFE(I)  =  ENFFX                                                  00023000
      FNTH(I)  =  ENTHX                                                  00023010
      ENFT(I)  =  FNFTX                                                  00023020
      SIGFF(I) =  G(1)                                                   00023030
      SIGTH(I) =  G(2)                                                   00023040
      SIGFT(I) =  G(3)                                                   00023050
      QFE(I)   =  QFFX                                                   00023060
      X(1,I)   =  2. * ROP * EMFTX - ENF * EMTHX                         00023070
      X(2,I)   =  EMFTX                                                  00023080
 1000 CONTINUE                                                           00023090
      DO   599   I = 1,N                                                 00023100
      IF(I .NE. 1)  GO TO 593                                            00023120
      FMFTP  =  (FMFT(2) - FMFT(1)) /DEL                                 00023130
      IF( RHOX(I) ) 596,592,596                                          00023140
C                                                  I = 1, CLOSED APEX   00023150
  592 EMFEP  =  (FMFE(2) - FMFE(1)) /DEL                                 00023160
      EMTHP  =  (FMTH(2) - FMTH(1)) /DEL                                 00023170
      QFE(1)  =  ELAM2 * (EMFEP + ENF * EMFTP)                           00023180
      QTH(1)  =  ELAM2 * (FMFTP - ENF * EMTHP)                           00023190
      GO TO  599                                                         00023200
  593 IF(I - N) 595,594,595                                              00023210
  594 FMFTP  =  (FMFT(N) - FMFT(N-1)) /DEL                               00023220
      GO  TO  596                                                        00023230
  595 FMFTP  =  (FMFT(I+1) - FMFT(I-1)) /DEL2                            00023240
  596 QTH(I)  =  ELAM2 /RHOX(I) *(X(1,I) + RHOX(I) * FMFTP)              00023250
  599 CONTINUE                                                           00023260
  700 CONTINUE                                                           00023270
      RETURN                                                             00023280
      END                                                                00023290
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$ORIGIN        CHAIN                                                          00023300
$IBFTC FSUMS                                                                  00023310
C     6J-167DR                                    FOURIER SUMMING             00023320
C                                                                             00023330
      SUBROUTINE SUMS                                                         00023340
C                                                                             00023350
      DIMENSION   R(200), D(200), FK(200), ENT(200), EMT(200), PFF(200),      00023360
     1  PTH(200), PN(200), WFF(200), ALF(200), DNA(200), WTHD(200),           00023370
     2  RHOX(200), GAMA(200), E1(200), T(200), FETH(200)                      00023380
      DIMENSION  USUM(200), VSUM(200), WSUM(200), EMFF(200), EMTH(200),       00023390
     1  EMFT(200), ENFE(200), ENTH(200), ENFT(200), SIGFE(200),               00023400
     2  SIGTH(200), SIGFT(200), QFF(200), QTH(200),                           00023410
     3  ZDOT(3,200), Z2DOT(3,200)                                             00023420
C                                                                             00023430
      REAL        MASS, LM11,LM22,LM33, MM11,MM22,MM33, NM11,NM22,NM33,     00023440
     1            MO                                                        00023450
C                                                                             00023460
      EQUIVALENCE      (DA(1),  EN   ),(DA(2),   AO   ),(DA(3),  HO   ),00023470
     1(DA(4),   EO   ),(DA(5),  SIGO ),(DA(6),  ENEO ),(DA(7),  ENEL ),00023480
     2(DA(8),  POI   ),(DA(9),  THETA),(DA(10),  PIXI ),(DA(11),  SPRL ),00023490
     3(DA(12),  UK   ),(DA(13),  VK  ),(DA(14),  WK   ),(DA(15),  EMK  ),00023500
     4(DA(16),  TAU1 ),(DA(17),  ENT1),(DA(18),  PI1  ),(DA(19),  TAU2 ),00023510
     5(DA(20),  ENT2 ),(DA(21),  PI2 ),(DA(22),  TAU3 ),(DA(23),  ENT3 ),00023520
     6(DA(24),  PI3  ),(DA(25),  MASS),(DA(26),  CFE  ),(DA(27),  CZ   ),00023530
     7(DA(28),  SKFE ),(DA(29),  SKZ ),(DA(30),  SUM  ),(DA(31),  EN1  ),00023540
     8(DA(32),  DFL  ),(DA(39),  DRW )                                    00023550
      EQUIVALENCE      (DA(40),  R    ),(DA(240),  WTHD ),(DA(440),  WFF  ),00023560
     1(DA(640),  GAMA ),(DA(840),  RHOX),(DA(1040),  D   ),(DA(1240),  FK  ),00023570
     2(DA(1440),  E1  ),(DA(1640),  ALF),(DA(1840),  DNA ),(DA(2040),  T   ),00023580
     3(DA(2240),  ENT ),(DA(2440),  EMT),(DA(2640),  PN  ),(DA(2840),  PFF),00023590
     4(DA(3040),  PTH ),(DA(3240),ZDOT),(DA(3440),  VZO ),(DA(3640),  AZO),00023600
     5(DA(3840),Z2DOT),(DA(4040),  VFO),(DA(4240),  AFO ),(DA(4440),  EM1),00023610
     6(DA(4456),  EM3 ),(DA(4472),  EM5),(DA(4476),  EM1N),(DA(4492),EM3N),00023620
     7(DA(4508),  EM5N)                                                   00023630
C                                                                             00023640
      COMMON    DA(4511), EM2(4,4), EM4(4,4), EM6(4), S1, S2, FLAM2,          00023650
     1  Z(4,200), X(4,200), A2(4,4), B2(4,4), C2(4,4), G2(4), E(4,4),         00023660
     2  F(4,4), GA(4,4), A(4,4), B(4,4), C(4,4), G(4), EC(4), DEL2,           00023670
     3  SL1, SL2, N, NTH, NTPR, NTPW, I, K, L,                                00023680
     4  S77, S78, BTA11, BTA33, MO(200), OMG2(200), ZP(3,200),                00023690
     5  Z2P(3,200), Z3P(3,200), TIMX, TDEL, PRNT, ENF, PRI, JT, NJT, VI       00023700
      COMMON                                                                  00023710
     1 USUM, VSUM, WSUM, EMFF, EMTH, EMFT, ENFF, ENTH, ENFT, SIGFF,           00023720
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     2 SIGTH, SIGFT, QFE, QTH                                          00023730
C                                                                      00023740
C                                                                      00023750
  755 S13  =  A0 * SIG0 /E0                                            00023760
      S14  =  SIG0 * H0 **3 /A0                                        00023770
      S16  =  SIG0 * H0                                                00023780
      DO   756  I = 1,N                                                00023790
      USUM(I)  =  S13 * USUM(I)                                        00023800
      VSUM(I)  =  S13 * VSUM(I)                                        00023810
      WSUM(I)  =  S13 * WSUM(I)                                        00023820
      EMFE(I)  =  S14 * EMFF(I)                                        00023830
      EMTH(I)  =  S14 * EMTH(I)                                        00023840
      EMFT(I)  =  S14 * EMFT(I)                                        00023850
      QFF(I)   =  S16 * QFE(I)                                         00023860
      QTH(I)   =  S16 * QTH(I)                                         00023870
      FNFE(I)  =  S16 * FNFF(I)                                        00023880
      FNTH(I)  =  S16 * FNTH(I)                                        00023890
  756 FNFT(I)  =  S16 * FNFT(I)                                        00023900
  730 WRITE           (6, 733)  TIMX, (I, USUM(I), VSUM(I), WSUM(I),   00023910
     1 EMFE(I), EMTH(I), EMFT(I), QFE(I), QTH(I), I = 1,N)             00023920
  733 FORMAT(1H1,28X, 39HDEFLECTIONS AND INTERNAL LOADS,  TIME =,1PE12.4,00023930
     1 /// 3X,1HI, 5X,4HU(I), 9X,4HV(I), 9X,4HW(I), 8X,6HM(PHI), 6X,    00023940
     2 8HM(THETA), 3X,12HM(PHI,THETA), 4X,6HQ(PHI), 6X,8HQ(THETA) //     00023950
     3 (I4, 8F13.4) )                                                  00023960
      WRITE           (6, 735) (I, ENFE(I), FNTH(I), FNFT(I), SIGFE(I), 00023970
     1 SIGTH(I), SIGFT(I),                    I = 1,N)                 00023980
  735 FORMAT(1H1,2X,1HI, 4X,6HN(PHI), 6X,8HN(THETA), 3X,12HN(PHI,THETA),00023990
     1 3X,8HSIG(PHI), 4X,10HSIG(THETA), 2X,13HSG(PHI,THETA) //          00024000
     2 (I4, 1P6E13.4) )                                                00024010
      WRITE (6,738) ((ZDOT(K,L), K=1,3), (Z2DOT(K,L), K=1,3), L=1,N)   00024020
  738 FORMAT(///10X,28HVELOCITIES AND ACCELERATIONS // 15X,6HVEL(U),   00024030
     1  10X,6HVEL(V), 10X,6HVEL(W), 10X,6HACC(U), 10X,6HACC(V), 1?X,    00024050
     2  6HACC(W) // (6X, 1P6E16.3) )                                   00024060
C                                                                      00024070
      WRITE(9)(USUM(I),I=1,N)                                          00024080
      WRITE(9)(WSUM(I),I=1,N)                                          00024090
      WRITE(9)(EMFE(I),I=1,N)                                          00024100
      WRITE(9)(FMTH(I),I=1,N)                                          00024110
      WRITE(9)(QFF(I),I=1,N)                                           00024120
      WRITE(9)(QTH(I),I=1,N)                                           00024130
      WRITE(9)(ENFE(I),I=1,N)                                          00024140
      WRITE(9)(FNTH(I),I=1,N)                                          00024150
      WRITE(9)(SIGFE(I),I=1,N)                                         00024160
```

```
      WRITE(9)(SIGTH(I),I=1,N)                                          00024170
      WRITE(9)(ZDOT(1,I),I=1,N)                                         00024180
      WRITE(9)(ZDOT(3,I),I=1,N)                                         00024190
      WRITE(9)(Z2DOT(1,I),I=1,N)                                        00024200
      WRITE(9)(Z2DOT(3,I),I=1,N)                                        00024210
  880 SL2  =  0.0                                                       00024220
      IF(TAU1 + TAU2 + TAU3 - TIMX .GT. 1.E-8)   GO TO 890              00024230
  888 SL1  =  1.                                                        00024240
C                                                                       00024250
  890 IF(DRW .NE. 0.)  SL1 = -2.                                        00024260
      RETURN                                                            00024270
      END                                                               00024280
```

```
      $ORIGIN         CHAIN,SYSUT2,REW                                        00024290
      $IBFTC LNK6                                                             00024300
      C     6J-148     ** LINK6                    PSEUDO  CRT  SUBROUTINE    00024310
      C                                                                       00024320
            SUBROUTINE  PIX                                                   00024330
      C                                                                       00024340
            L0  =  0                                                        00024350
            RETURN                                                          00024360
            END                                                             00024370
```

```
$DATA                                                                    00024380
      1                    1                   75          80      81    00024390
HYDROELASTIC RESPONSE APOLLO SPHERE ** FIXED BND.- P(..) IN ANALYTIC FORM00024400
 10 ITERATIONS TO 2.0  AS RESTART  ** POI=.33,EN=120., RHO=.000975       00024410
OPEN ANGLE=19.53, D=3.33E+6, K=3.33E+6, E=29.7E+6, DNA=1.025IN, RC=175.600024420
 62.5      10000.0                                                       00024430
     1    0.01                25          0                            00024440
     2    1.          1.      1.          1.        0.0                00024450
     7    0.0         0.33    0.0         0.0                          00024460
    16    2.0   -3    20.     1.                                       00024470
    21                                                  .975  -300024480
    30    -1.                                                          00024490
    33    -1.         360.                1.0         0.               00024500
  4476    1.0   +10   3.0                                              00024510
     1    2.0         120.0       -1.0    175.6       0.0              00024520
     6    0.0         19.530                                           00024530
     1    1.0   +10   3.33    +6                                       00024540
    42    1.0   +10   3.33    +6                                       00024550
    83    1.0   +10   29.7    +6                                       00024560
   165    1.0   +10   1.025                                            00024570
```

```
$IBFTC DECRD                                                        DECRD000
       SUBROUTINE DECRD(D)                                          DECRD005
       DIMENSION  FLT(5), ID(2), D(1)                               DECRD010
   10  READ (5,100) LOC, FLT, ID                                   DECRD015
  100  FORMAT (I12, 5E12.0, 1A6, 1A2)                              DECRD020
       IF (LOC .EQ. 0)   GO TO 500                                  DECRD025
   15  K = IABS(LOC) - 1                                           DECRD030
       DO 20 I = 1,5                                                DECRD035
       IF (SIGN(1.0,FLT(I)).LT.0.0 .AND. FLT(I) .EQ. 0.0)  GO TO 20 DECRD040
       J = K + I                                                    DECRD045
       D(J) = FLT(I)                                                DECRD050
   20  CONTINUE                                                     DECRD055
       IF (LOC .LT. 0)  GO TO 1000                                  DECRD060
       GO TO 10                                                     DECRD065
  500  WRITE (6,200) ID                                            DECRD070
  200   FORMAT(10H0BAD DATA 1A6,1A2)                                DECRD075
       CALL EXIT                                                    DECRD080
 1000  RETURN                                                       DECRD085
       END                                                          DECRD090
```